OOTACAMUN

P.W.D.
IRRIGATION.
OOTACAMUND.

PUBLIC WORKS DEPARTMENT.

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TO THE

PROCEEDINGS OF THE MADRAS GOVERNMENT,

RELATING TO IRRIGATION.

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IRRIGATION.

PROCEEDINGS OF THE MADRAS GOVERNMENT,

PUBLIC WORKS DEPARTMENT,

For the Month of June 1876.

No. 3. Read the following letter from Colonel F. J. MOBERLY, R.E., Superintending Engineer, Chingleput, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Camp at Seemapuram, 18th May 1876, No. 602 :—

I HAVE the honor to enclose translation of a plaint against me and my reply, and request permission to defend it at the expense of Government.

1 Translation of Plaint.
1 Draft reply.

No. 4. ORDER THEREON, 1st June 1876, No. 1,358.

IRRIGATION, No. 1.
Establishment.

THE Superintending Engineer, Chingleput, is authorized to defend the suit, and on the result being reported it will be determined whether the costs, if any, will be borne by Government.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 24. Read the following letter from Major J. O. HASTED, R.E., Superintending Engineer, Kistna, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Masulipatam, 11th May 1876, No. 20 :—

IN consequence of the removal of Lieutenant Campbell from the district, I have transferred Mr. Norris, Executive Engineer, from the 1st Range to the 7th Range.

2. The first Range Office has been, for years past, held in a building at Duggirala, the private property of Mr. Norris. He is now anxious to dispose of all the buildings at Duggirala, and the present Range Officer, Mr. Sub-Engineer Carlier, is not likely to require them. Considering that no compensation has been made to Mr. Norris for the use of the bungalow for seven years, I propose that Government should purchase his property at Duggirala for the sum he asks, Rupees 600.

3. Until the erection of Range Officers' houses, the main building will be available as a Rest-house, and then the materials may be used. The bungalow has lately been repaired and out-houses rebuilt of stone in mud, the repairs having cost more than the sum now asked.

4. Should the proposal to purchase the buildings not meet with the approval of Government, I would suggest that a monthly rent of 15 Rupees should be paid to Mr. Norris, for the use of the buildings, until new Range Offices are built.

No. 25. ORDER THEREON, 1st June 1876, No. 1,368.

IRRIGATION, No. 2.
Account.

THE rental of the buildings referred to, as long as they may be required for a Range Office, is sanctioned.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following :—

No. 53 W.

No. 28. *Note by the Chief Engineer for Irrigation.*

No. 11, dated 7th April 1876.

THE Officiating District Engineer, Kurnool, forwards with his letter marginally noted an estimate in connection with the Markapur Tank situated in the Markapur taluq, Cumbum range.

2. The nature of the work proposed for execution and the heads of account to which it is chargeable are as follow :—

	RS.
Constructing a surplus weir and closing the natural escape. Capital—Ordinary	3,120
Repairing the bund and sluice. Revenue—Repairs	1,200
	4,320

3. The following particulars of this tank are recorded :—

Ayacut area	Acres	567
Assessment	Rupees	4,812
Average revenue	„	2,847
Highest do.	„	5,051
Expenditure during the previous four years	„	5,969

The area of the catchment basin is 30 square miles; the maximum flood supply is calculated at 5,428 cubic feet per second for discharging which as surplus there are at present two outlets, a natural escape with 69 feet waterway at the west end, and a weir 81 feet long at the east end. These escapes are altogether inadequate, and it is stated that the escape at the west end occasions loss of water whereby the area of irrigation is diminished and the revenue suffers, but the longitudinal section does not indicate this. It is intended to close the natural escape and to discharge all

surplus at a weir 538 feet long which is to occupy a site of which the present 81 feet weir forms a part. This weir is shown in the estimate as to—

	RS.	A.	P.	RS.	A.	P.
Cost	...			2,150	0	0
But the following subsidiary works are a part of its cost and should be included therein :—						
Embankments behind wings	79	9	6			
Tamping embankments	13	4	3			
Excavating channel in front of escape... ...	423	2	4			
Removing bund at escape site	157	4	0			
Sundries and superintendence	56	11	11			
				730	0	0
Closing natural escape				240	0	0
				3,120	0	0

4. The other works of the estimate are—

	RS.	A.	P.	RS.	A.	P.
1. Repairs, earthworks	96	5	9			
Sundries, &c.	7	10	3			
				104	0	0
2. Repairing a sluice	...			370	0	0
3. Gravelling the bund	667	2	7			
Sundries, &c.	58	13	5			
				726	0	0

The first two of the above items are the only repair works, and together amount to Rupees 474.

5. The gravelling of the bund is reported to be necessary, because the village is so situated that the cattle have to use the bund as a roadway, and the constant traffic has made it very irregular. Before, however, a fourth of the average revenue is spent upon work of this kind, the circumstances should be more fully explained and a sketch of the locality furnished, and the proposition should be further supported by the Collector's opinion that this work should be carried out by Government without any contribution from the villagers on whom should, it would seem, fall the obligation of making good damage caused by their cattle.

6. The improved arrangements for the disposal of surplus do not come properly under the definition of Minor New Works, neither can the small district grant provide for them; they form a Major Work which should be entered in the Budget Estimate for next year.

7. The following, therefore, are the recommendations for sanction made in this note :—

	RS.
Repairs to bund	104
Do. to sluice	370
Total ...	474

For entry in the Budget of 1877-78—

Constructing new surplus weir 3,120

8. The District Engineer has furnished no particulars of the work done by the expenditure of Rupees 5,969 on the tank in the last four years, and this omission should be made good. It is always necessary to afford full information when the expenditure on maintenance of Irrigation Works is shown to be abnormally great.

20*th May* 1876. (Signed) A. DEC. SCOTT, Major, R.E.,
Deputy Chief Engineer for Irrigation,
for *Chief Engineer for Irrigation.*

To the Secretary to Government, Public Works Department.

No. 29. ORDER THEREON, 1st June 1876, No. 1,370.

IRRIGATION, No. 3.
Account.

THE following estimates from the Cumbum range, forwarded by the Officiating District Engineer, Kurnool, are sanctioned:—

Markapur Tank.

	RS.
For entry in the Budget of 1877-78—	
No. $\frac{38\text{-I}}{1}$ of 1876-77. Constructing a surplus weir and closing the natural escape. Capital—Ordinary...	3,120
For execution from district grant for Repairs—	
No. $\frac{38\text{-I}}{2}$ of 1876-77. Repairing the bund and sluice—Revenue I.B., Maintenance and Repairs	474
Total ...	3,594

2. These sanctions have been registered as shown above.

3. The District Engineer will supply the information referred to by the Chief Engineer for Irrigation regarding the results of the previous outlay on this tank.

4. The disposal of the part of the estimate providing for gravelling the bund will be deferred pending a further report.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 30. Read the following Proceedings of the Madras Government in the Revenue Department, dated 31st March 1876, No. 458 :—

ABSTRACT.—*Compensation for Inam land taken up for public purposes in Chingleput District.*—Sanctioning payment of Rupees 56-4-4 from Imperial Funds as —, and requesting provision of funds by the Public Works Department.

No. 31. ORDER THEREON, 1st June 1876, No. 1,371.

IRRIGATION, No. 4.
Account.

COMMUNICATED to the Examiner of Public Works Accounts for adjustment under the Rules.

MADRAS WATER WORKS.
Head of Service.—Irrigation.
Fund.—Capital—Ordinary.
Class.—I. Works.
Main-head.—(2) Main Canal and Branches. Cholaveram Supply Channel.
Sub-head.—B Land.
Amount.—Rupees 56-4-4.

2. The expenditure will be classified as shown in the margin.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following :—

No. 55 W.

No. 41. *Note by the Chief Engineer for Irrigation.*

THE following estimates from the Chingleput range are forwarded by the Superintending Engineer, Chingleput, with his letter marginally noted :—

No. 46, dated 5th April 1876.

Kursungal Group.

Taluq.	Village.	Work.	Amount.
			RS.
Madranticum	Moonaccolum.	S. No. 129 V. Tank	815
Do.	Moorongay ...	Do. 130 „	832
Do.	Alloor ...	Do. 131 „	500
Do.	Kursungal ...	Do. 132 „	1,605
Conjeveram	Karanai ...	Do. 233 „	710

2. The financial and hydraulic details of the Irrigation Works concerned are exhibited in the following statement :—

I.—Financial Details.

Name of Work.	Ayacut Area.	Assessment.	Average Revenue for 5 years.	Highest Revenue for 5 years.	OUTLAY. During the previous 4 years.	OUTLAY. Proposed. Capital.	OUTLAY. Proposed. Revenue.	OUTLAY. Proposed. Average annual proportion of Charges to Revenue.
	ACRES.	RS.	RS.	RS.	RS.	RS.	RS.	PER CENT.
Moonaccolum Tank	50	255	254	278	219	...	815	81·4
Moorongay „	48	279	371	481	398	...	832	66·3
Alloor „	45	145	134	137	...	...	500	74·6
Kursungal „	103	425	407	425	...	...	1,605	78·8
Karanai „	60	192	153	190	...	...	710	92·6

II.—Hydraulic Details.

Name of Work.	Catchment Basin, Area.	Maximum Supply. Catchment per Second.	Maximum Supply. Channels per Second.	Length of Escape. Total.	Length of Escape. Effective.	Average Height of Bund. Above F. T. L.	Average Height of Bund. Above M. T. L.	Surplus discharged at M.T.L. per Sec.	Tanks above.
	SQ. M.	C. FT.	C. FT.	FT.	FT.	FT.	FT.	C. FT.	NO.
Moonaccolum Tank ...	1·5	737	...	E 72 E 252	72 252	1·62 3·00	0·12 1·50	296·2 777·6	...
Moorongay Tank	2·5	1,036	...	E 30 E 346	30 346	1·50 3·00	0·00 1·50	123·4 1,067·7	1
Alloor Tank	·75	464	...	... E 180	... 180	3·00 3·00	1·50 1·50	0·0 555·5	...
Kursungal Tank	4·5	1,533	...	E 750 E 510	750 510	2·50 4·00	0·50 2·00	4751·5 2,423·2	3
Karanai Tank	1·0	562	...	E 42 E 182	42 182	1·00 3·00	0·00 1·50	172·8 561·6	...

NOTE.—The proposed dimensions of escapes and heights of bund are printed in large type. The existing dimensions in small type. The following abbreviations are used :—C.—Calingulah with dam stones. W.—Weir with flush crest. E.—Escape at ground level. B.—Bund of tank. S.—Revenue Survey. V.—Village.

3. The following is a summary of the work proposed to be carried out in each case :—

Moonaccolum Tank.—Raising and repairing the bund, repairing the sluice, and forming an escape planted with grass.

Moorongay Tank.—Raising and repairing the bund, repairing two sluices, and forming an escape planted with grass.

Alloor Tank.—Repairing the bund and sluice, and forming an escape planted with grass.

Kursungal Tank.—Raising and repairing the bund, repairing the sluice, and forming an escape planted with grass.

Karanai Tank.—Raising and repairing the bund, forming an escape planted with grass, and constructing an irrigation sluice.

4. These estimates which are for tanks forming one group are recommended for sanction.

5. The following statement shows the proposed distribution of the outlay recommended for sanction to the debit of the several heads of account involved :—

Names of Tanks.	Items of Estimate.	FUND.			Total for each Tank, &c.
		Capital, Ordinary.	REVENUE.		
			Extensions and Improvements	Repairs.	
Moonaccolum Tank ...	Raising and repairing the bund and repairing the sluice	...	...	783	815
	Forming an escape planted with grass.	...	32	...	
Moorongay Tank ...	Raising and repairing the bund, and also repairing two sluices	...	...	780	832
	Forming an escape planted with tank grass	...	52	...	
Alloor Tank ...	Repairing the bund and sluice ...	...	...	476	500
	Forming an escape planted with grass...	...	24	...	
Kursungal Tank ...	Raising and repairing the bund, also repairing the sluice	...	...	1,510	1,605
	Forming an escape planted with grass.	...	95	...	
Karanai Tank ...	Raising and repairing the bund ...	...	...	375	710
	Forming an escape planted with grass.	...	25	...	
	Constructing an irrigation sluice to replace an old one	...	310	...	

(Signed) A. DEC. SCOTT, Major, R.E.,

20*th May* 1876.

Deputy Chief Engineer for Irrigation,

for *Chief Engineer for Irrigation.*

No. 42. ORDER THEREON, 2nd June 1876, No. 1,376.

IRRIGATION, No. 5.
Account.

No. 55 W., dated 20th May 1876.

THE following estimates for Irrigation Works in the Chingleput Range, Chingleput District, forwarded by the Chief Engineer for Irrigation with his memorandum marginally noted are sanctioned :—

Irrigation.

Name of Work.	Item of Estimate.	Fund.	Amount.	Irrigtion Registary No.
			RS.	
Moonaccolum Tank ...	Raising and repairing the bund and repairing the sluice.	Revenue—I.B., Maintenance and Repairs.	783	39 I/1 } 39 I.
Do. ...	Forming an escape planted with grass ...	Revenue—I.A., Extensions and Improvements.	32	39 I/2 } 39 I.
Moorongay Tank ...	Raising and repairing the bund, and repairing two sluices.	Revenue—I.B., Maintenance and Repairs.	780	40 I/1 } 40 I.
Do. ...	Forming an escape planted with grass...	Revenue—I.A., Extensions and Improvements.	52	40 I/2 } 40 I.
Alloor Tank	Repairing the bund and sluice ...	Revenue—I.B., Maintenance and Repairs.	476	41 I/1 } 41 I.
Do. ...	Forming an escape planted with grass...	Revenue—I.A., Extensions and Improvements.	24	41 I/2 } 41 I.
Kursuggai Tank ...	Raising and repairing the bund and repairing the sluices.	Revenue—I.B., Maintenance and Repairs.	1,510	42 I/1 } 42 I.
Do. ...	Forming an escape planted with grass...	Revenue—I.A., Extensions and Improvements.	95	42 I/2 } 42 I.
Karanai Tank ...	Raising and repairing the bund ...	Revenue—I.B., Maintenance and Repairs.	375	43 I/1 } 43 I.
Do. ...	Forming an escape planted with grass...	Revenue—I.A., Extensions and Improvements.	25	43 I/2 } 43 I.
Do. ...	Constructing an irrigation sluice to replace an old one.	Revenue—I A., Extensions and Improvements.	310	43 I/3 } 43 I.

2. These sanctions are registered as shown above.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 43. Read the following letter from Major J. O. HASTED, R.E., Superintending Engineer, Kistna, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Camp at Pamurroo, 27th April 1876, No. 10 :—

REFERRING to paragraph 2 of my letter printed in G.O., No. 1,085, dated 17th April 1875, I have the honor to forward herewith an estimate, amounting to Rs. 315, for the conservancy of the Pedda Kuncherla tank during 1876-77, and to request sanction to the same under " Capital, " as the last year's estimate, Rupees 720, was taken by the Examiner of Public Works Accounts under that head—*vide* paragraph 1 of Government Order above quoted—and the unspent balance* thereof will be worked out for the first $5\frac{1}{2}$ months of this year out of Capital, Ordinary, Minor New Works, lump grant Rupees 3,500 in Irrigation Budget (Preliminary Issue).

* Rupees 166-14-0.

No. 44. ORDER THEREON, 2nd June 1876, No. 1,377.

IRRIGATION, No. 6.

HIS GRACE the Governor in Council considers it undesirable to sanction another conservancy estimate for the Pedda Kuncherla tank. It appears that a balance of the sanction accorded in G.O., 17th April 1875, No. 1,085, sufficient for conservancy purposes for $5\frac{1}{2}$ months of the current year remained available on the 1st April; and these Proceedings will be communicated to the Revenue Department with a view to the Collector of the Kistna

being instructed to place the tank under the care of the village officers from the 1st September next.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 115. Read the following letter from Colonel C. V. WILKIESON, R.E., Superintending Engineer, Coimbatore, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Coonoor, 13th May 1876, No. 20 :—

IN reply to G.O., dated 10th April 1876, No. 937, requesting me to give my decided opinion as to whether the maintenance of the Caniempolliem anicut requires professional agency, I have the honor to inform you that I am decidedly of opinion that if the repairs to the Caniempolliem anicut are to be undertaken they require professional agency, but that the maintenance of the Caniempolliem channel does not require any professional assistance. I would at the same time strongly deprecate any more waste of money on the work, which experience shows us that the repairs of one season were always destroyed in the next. These repairs were done by the Engineer Department certainly, but I cannot hope for any improved result from their being estimated for, and carried out by the Civil Authorities.

2. As I have before stated in my letter,* No. 145 of 13th February 1875, the cultivation paid for is "kar" or three months' crop, and the river is always from June to October sufficiently full to fill the channel, and if it happened to fail the ryots could put up a temporary whagany to increase the supply, which used always to be done by kody maramut.

* Printed with G.O., No. 694 of 11th March 1875.

3. If after the Collector has tried to manage this irrigation work for the five or six years, as laid down in G.O., No. 1,299 of 7th May 1875, he finds it is a failure, then it would be time to consider if it is worthwhile to build a masonry rough stone wall, which is the way that all these rough stone native anicuts have to be treated. Formerly they paid well enough, as the yearly repairs were always done by the ryots, free of cost, a course which has exploded of late years.

No. 116. ORDER THEREON, 7th June 1876, No. 1,417.

IRRIGATION, No. 7.

HIS GRACE the Governor in Council is of opinion that the Caniempolliem channel should be kept in repair under the Collector's orders, and that no further expenditure should be incurred, at any rate for the present, on the anicut. Should it be found that in ordinary seasons a kar crop cannot be effectively irrigated without the anicut, the question of constructing a weir on a better model will be considered, and in the meantime the Superintending Engineer will take measures for ascertaining whether there is rock on which to found a work of this kind.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following :—

No. 32 W.

No. 122. *Note by Chief Engineer for Irrigation.*

THE District Engineer, Bellary, forwards with his letter marginally noted an estimate in connection with the Bachapully tank, situated in the Ghooty taluq, Ghooty range.

No. 2,960, dated 28th February 1876.

2. The nature of the work proposed for execution and the heads of account to which it is chargeable are as follow :—

	RS.
Repairing the bund and closing the breach. Revenue Repairs ...	1,656
Widening the apron of the existing weir. Removing and rebuilding one of the wing walls. Revenue Extensions and Improvements.	724
Constructing a masonry weir. Capital—Ordinary	2,170
	4,550

3. The following particulars of this tank are recorded :—

Ayacut area	Acres	182
Assessment	Rupees	867
Average revenue	"	756
Highest do.	"	880
Expenditure during the previous four years	"	123

The area of the catchment basin is $4\frac{1}{2}$ square miles; the maximum flood supply is calculated at 1,836 cubic feet per second, for discharging which as surplus there is one weir 54 feet in length and one natural escape 36 feet in length. It is proposed to construct a masonry weir 140 feet in length to replace the natural escape which is to be extended; this arrangement will give 194 feet as the length of crest available for the discharge of the surplus. The estimate provides for repairing the bund, closing the breach, widening the apron of the existing weir and constructing a masonry weir.

The Bachapully tank breached in October 1873, the tank was temporarily secured by a ring-bund and the breach subsequently repaired as an emergent work nearly a year ago in anticipation of sanction. The estimate for the repair of the breach and for constructing the works necessary to prevent a recurrence of failure was not received in this office till June 1875. The documents submitted were incomplete and the information given insufficient to enable an opinion to be passed on the works provided, and they were returned to the District Engineer in July 1875 for revision. The revised estimates now received reached this office on the 1st March last.

This extraordinary delay in providing for the requirements of the tank which lies above and is a source of danger to the Madras Railway has not been satisfactorily accounted for by the Range Officer, the District Engineer's opinion being that the size of the range which is large is counterbalanced by the fact that the railway traverses it and that there are few works going on.

It appears also that there has been a very extraordinary misconception on the part of the Range Officer with reference to the instructions issued from this office for the repair of breaches in general, and that pervious material has been designedly placed to form the portion of the bank next to the water instead of being carefully reserved for use in rear. This must be remedied as soon as practicable, unless the tank has already filled and been found to be entirely free from leakage, by stripping

the revetment and laying a puddle wall against the face of the bund at the site of the breach, and the District Engineer should issue the necessary detailed instructions.

The rates for rubble masonry built with new and old stone are Rupees 2-8-6 and 3-12-9 respectively, the rate per stone being 1 Rupee a cubic yard. The cost therefore of chunam, sand, and labor is Rupees 2-8-6 and 2-12-9 a cubic yard, and these rates are about double those usual. The District Engineer has noticed that the rates especially in the Ghooty range are very high, and he should see that no unnecessary expenditure is allowed.

The data in Nellore are as follow :—

¾ Cubic yard (solid) of picked rough stone at   Rupee per cubic yard.
3 Cart loads   miles at   Anna per cart.
2 Parahs of chunam at   Annas per parah.
4 Do. of sand at   Pice per parah.
1 Bricklayer at   Annas.
1 Man cooly at   Annas.
3 Small coolies at   Annas.
Sundries   Pice.

The District Engineer will make further inquiries into the executive work in the Ghooty range, and should suggest to the Chief Engineer, Public Works Department, such measures as may appear to be necessary in order to ensure the more rapid and efficient management of the work.

The estimates are forwarded for sanction.

(Signed) A. deC. SCOTT, Major, R.E.,
7th April 1876. *Dy. Chief Engineer for Irrigation*,
for *Chief Engineer for Irrigation.*

To the Secretary to Government, Public Works Department.

No. 123. ORDER THEREON, 7th June 1876, No. 1,420.

IRRIGATION, No. 8.
Account.

THE following estimate from the Ghooty Range, forwarded by the District Engineer, Bellary, is sanctioned :—

BACHAPULLY TANK.

Irrigation.

			RS.
No. 46 I. of 1876-77.	46 I./1 Constructing a masonry weir.	Capital—Ordinary—I. Work.	2,170
	46 I./2 Widening the apron of the existing weir. Extensions and Improvements	Revenue—I.A.	724
	46 I./3 Repairing the bund and closing the breach. Maintenance and Repairs	Revenue—I.B.	1,656
		Total...	4,550

2. The remarks of the Chief Engineer for Irrigation on the rates for rubble masonry built with old and new stone respectively should receive the District Engineer's careful consideration.

3. This sanction has been registered as shown above.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 128. Read the following Proceedings of the Board of Revenue, dated 4th May 1876, No. 1,179 :—

Read the following letter from J. D. B. GRIBBLE, Esq., Acting Collector of Cuddapah, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Madanapully, 25th April 1876, No. 98.

WITH reference to Board's Proceedings, No. ——, dated 21st instant, I have the honor to state that I do not think that action, under Chapter XXXIX of the Criminal Procedure Code, is advisable in this case for the following reasons.

2. The tank bund is reported to require repair, and danger is anticipated, because the waterway of the calingulah is insufficient, but whatever danger there may be is actually increased by the Government authorities by the construction of the separating bund between the Jillalamadaka tank and the Government Korlacuntla tank. It has been decided that that bund should be built, and the effect of it will be to prevent water flowing from the Shrotriem to the Government tank. The whole of the water which comes into the Shrotriem tank will, therefore, have to find an escape over the Shrotriem calingulah, whereas formerly a great portion went over the calingulah of the Government tank, which tank is on a lower level than the Shrotriem one. As regards action under Chapter XXXIX therefore, it seems to me that it would be necessary to serve a notice not only on the Shrotriemdars, but also on the Public Works Department Officers.

3. I have not seen the Advocate-General's opinion, but it seems to me clear that a Magistrate could not take action under Section 518, because the danger is not imminent (*vide* explanation 1), the tank being at present empty, nor can it now be said when danger will occur, because it is impossible to foretell when the tank may receive a supply. The other section under which action could be taken is 521, but I feel considerable doubt whether an order to repair the tank under this section might not be upset on appeal or reference to the High Court. The section provides what is to be done in the case of a building being dangerous from a state of weakness or from a tank or well being unfenced, but it does not seem to contemplate repairs to the bund and calingulah of a tank of this kind. I may be wrong in this opinion, which I venture with diffidence, and therefore, if the Board of Revenue think I am in error and direct me to do so, I will take action under the chapter.

4. I have requested the District Engineer to prepare at once an estimate of the approximate cost of the necessary repairs, and have also requested him to give his opinion regarding the imminency of the danger.

5. My own opinion is that we should take the matter into our own hands and execute the repairs, leaving the amount to be recovered hereafter by suit. At the same time I feel bound to say that, owing to the peculiar circumstances of the case by the construction of the separating bund, it is, in my opinion, very possible that in a suit the Government would be cast.

THE question of the liability of the Shrotriemdars is undoubtedly complicated by the separating bund between the Jillalamadaka and Korlacuntla tanks, but the

Board understood from the enclosures to the Collector's letter of the 11th April, which have been forwarded to Government and are not available for reference, that the bund was of long standing and had recently been rebuilt but not newly constructed. A division between the two tanks is clearly shown on the Trigonometrical Survey Map published nearly thirty-five years ago, from which it is to be inferred that a bund was in existence at the time of the survey. The Board do not, however, recollect any mention hitherto of the fact that formerly a great portion of the surplus water from the Shrotriem tank passed over the calingulah of the Government tank, the latter being on a lower level than the former. If there is good ground for supposing this to have been the case, there will be difficulty in fixing responsibility on the Shrotriemdars.

2. The question whether Mr. Gribble would be justified, under the circumstances, in taking action under Chapter XXXIX of the Code of Criminal Procedure is one on which the Board cannot issue instructions. A copy of the Advocate-General's opinion on the general question will now be furnished for his information, and he must decide for himself whether the circumstances warrant interference in his Magisterial capacity. As regards the imminence of the danger, however, the Board remark that the rainfall during the storms which frequently occur at this time of the year would suffice to fill the tank in a few hours and to breach it should no sufficient escape be provided.

3. The Board consider that immediate steps should be taken to render the tank safe; and, if Mr. Gribble is not satisfied of his power to act as a Magistrate in this case, he must take action as Collector in consultation with the District Engineer, and he will be instructed to this effect by telegram. The Court being closed, an application for an injunction to compel the Shrotriemdars to take the precautions requisite is impossible, and the Collector and District Engineer must decide what is the best mode of ensuring the safety of the tank and railway line. It should be considered whether there is any objection to breaching the dividing bund. The outlay must be defrayed by Government for the present; it will be considered hereafter on receipt of fuller information whether a suit should be instituted to recover the amount from the Shrotriemdars.

(A true Copy and Extract.)

(Signed) C. A. GALTON,
Acting Secretary.

No. 129. ORDER THEREON, 7th June 1876, No. 1,423.

IRRIGATION, No. 9.

COMMUNICATED to the District Engineer, Cuddapah, in continuation of G.O., 4th May 1876, No. 1,102. It is observed with reference to paragraph 1 of the Board's Proceedings that the facts of the case, so far as ascertainable from levels or demonstrable from the circumstances, should be fully inquired into and settled.

2. His Grace the Governor in Council also considers that, with reference to the papers printed in Proceedings, Madras Government, No. 1,102, of the 4th May last,

the Consulting Engineer for Railways should ascertain whether the 30 feet waterway on the railway is sufficient to pass the drainage of 10 square miles, the flood discharge from which is estimated by the District Engineer at 2,611 cubic feet a second.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 134. Read the following letter from Captain L. CONWAY-GORDON, R.E., Examiner of Public Works Accounts, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Fort St. George, 29th May 1876, No. 54 W :—

WITH reference to the Proceedings of Government, No. 640, of the 13th March 1876, communicating the sanction of the Government of India to an additional grant of Rupees 10,000 to Ordinary for survey establishments for 1875-76, I have the honor to request that you will be so good as to inform me how that sum should be distributed to the several funds, *viz.*, 'Capital Ordinary,' 'Revenue,' and 'Ordinary Agricultural.'

No. 135. ORDER THEREON, 7th June 1876, No. 1,426.

IRRIGATION, No. 10.
Account.

THE grant of Rupees 15,000, to which the grant of Rupees 10,000 referred to by the Examiner was supplementary, not having been distributed between Capital Ordinary, Revenue, and Ordinary Agricultural, the apportionment of the supplemental grant is not practicable without information from the Examiner as to the expenditure under each of these heads during 1875-76, when a distribution of the whole grant to cover the expenditure can be made.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following :—

No. 58 W.

No. 136. *Note by the Chief Engineer for Irrigation.*

No. 10, dated 30th March 1876.

THE following estimates from the Kurnool and Cumbum ranges are forwarded by the District Engineer, Kurnool, with his letter marginally noted :—

Taluq.	Village.	Work.	Amount.
			RS.
Nundicotcoor	...	Dumaguttah V Tank	1,670
Markapur	...	Gobbore V Tank	140

2. The financial and hydraulic details of the Irrigation Works concerned are exhibited in the following statement:—

I.—Financial Details.

Name of Work.	Ayacut Area.	Assessment.	Average Revenue for 5 years.	Highest Revenue for 5 years.	OUTLAY.			
					During the previous 4 years.	PROPOSED.		
						Capital.	Revenue.	Average annual proportion of charges to Revenue.
	ACRES.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
Dumaguttah Tank	38	Not given.	337	370	150	465	1,205	108
Gobbore Tank	43	459	195	344	377	...	140	53

II.—Hydraulic Details.

Name of Work.	Catchment Basin Area.	MAXIMUM SUPPLY.		LENGTH OF ESCAPE.		AVERAGE HEIGHT OF BUND.		Surplus discharged at M.T.L. per Sec.	Tanks above.
		Catchment per Second.	Channels per Second.	Total.	Effective.	Above F.T.L.	Above M.T.L.		
	SQ. M.	C. FT.	C. FT.	FEET.	FEET.	FEET.	FEET.	C. FEET.	No.
Dumaguttah Tank ...	6	2,227	...	Not stated. W. 150 E. 70	Not stated. 220	4·5 4·5	2·5 2·5	0·0 1868·9	Not stated.
Gobbore Tank ...	3	1,170	...	E. 124 E. 124	124 124	6·0 6·0	4·0 4·0	785·5 785·5	1

NOTE.—The proposed dimensions of escapes and heights of bund are printed in large type. The existing dimensions in small type. The following abbreviations are used:—C.—Calingulah with dam stones. W.—Weir with flush crest. E.—Escape at ground level. B.—Bund of tank. V.—Village. S—Revenue Survey.

3. The following is a summary of the work proposed to be carried out in each case:—

Dumaguttah Tank.—Raising, repairing, and lengthening the bund, repairing the sluice, constructing a masonry weir, widening the existing natural escape, and constructing an irrigation sluice in lieu of the old one worn out.

Gobbore Tank.—Repairing the bund and sluice.

4. It is stated that the proposed alterations to the Dumaguttah tank will result in large increase of revenue. The reasons for forming this anticipation should have been more fully detailed. The amount of increased storage capacity given to the tank by the extension of the bund should have been approximately stated as well as the authority on which it is taken for granted that there is additional land fit for irrigation and that it will be taken up.

The catchment basin is certainly of considerable size and can supply a very much larger area, so that the view taken by the officers concerned is probably correct. It would have been better had some demonstration been volunteered. The estimates are recommended for sanction.

5. The following statement shows the proposed distribution of the outlay recommended for sanction, to the debit of the several heads of account involved:—

Name of Tank.	Items of Estimate.	FUND.			Total for each Tank, &c.
		Capital, Ordinary.	REVENUE.		
			Extensions and Improvements.	Repairs.	
	Kurnool Range.				
Dumaguttah Tank ...	Repairing the bund and sluice	...	...	905	1,670
	Constructing a masonry weir	465	...	...	
	Widening the existing natural escape ...	...	20	...	
	Reconstructing an irrigation sluice ...	...	...	280	
	Cumbum Range.				
Gobbore Tank ...	Repairing the bund and sluice	...	...	140	140

(Signed) A. deC. SCOTT, Major, R.E.,
Dy. Chief Engineer for Irrigation,
for *Chief Engineer for Irrigation.*

To the Secretary to Government, Public Works Department.

No. 137. ORDER THEREON, 7th June 1876, No. 1,427.

IRRIGATION, No. 11.

Account.

No. 58 W., dated 31st May 1876.

THE following estimates for Irrigation Works in the Kurnool and Cumbum Ranges, Kurnool District, forwarded by the Chief Engineer for Irrigation with his memorandum marginally noted, are sanctioned.

Name of Work.	Item of Estimate.	Fund.	Amount.	Irrigation Registry No.	
	Kurnool Range.				
Dumaguttah Tank ...	Repairing the bund and sluice ...	Revenue—I.B. Maintenance and Repairs.	905	44 I / 1	44 I.
	Constructing a masonry weir ...	Capital, Ordinary ...	465	44 I / 2	
	Widening the existing natural escape.	Revenue—I.A. Extensions and Improvements.	20	44 I / 3	
	Reconstructing an irrigation sluice ...	Revenue—I.B. Maintenance and Repairs.	280	44 I / 4	
	Cumbum Range.				
Gobbore Tank ...	Repairing the bund and sluice ...	Revenue—I.B. Maintenance and Repairs.	140	45 I.	

2. These sanctions are registered as shown above.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 167. Read the following endorsement of the Chief Engineer for Irrigation, dated Ootacamund, 24th May 1876, No. 66 W :—

From Major J. O. HASTED, R.E., Superintending Engineer, Kistna, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Masulipatam, 10th May 1876, No. 17.

WITH reference to G.O., No. 434, dated 17th February 1876, I have the honor to inform you that as I felt somewhat doubtful of the circumstances of the Colair lake being fully understood, I arranged to pay a visit to Kottada (where the calingulah and breach are situated) when the lake should be nearly at its lowest.

2. On mentioning my proposed visit to the Collector, he at once agreed to accompany me and procured the attendance of the Tahsildar of Gudiwada and Deputy Tahsildar of Kykaloor. Major Beatty and Lieutenant Langley, R.E., were kind enough to arrange to meet us, and at Major Beatty's request the Tahsildars of Ellore and Bhimavaram and the Tanadar of Bhittezalli also attended. The 7th Range Officer accompanied us and the subordinates employed in the adjacent taluqs of both the Godavery and Kistna Districts, and we were met by a large number of ryots. The opinions of nearly all those interested in the cultivation about the lake were therefore obtained.

3. We met the officers of the Godavery District at Kondanghi on the Uppateru, nearly opposite the Yailoorpaud lock, and proceeded by boat to Kottada. The Uppateru from Kondanghi to the point where its old course to Akeed turns to the east is a fine creek, its width even at low water being about 300 feet and depth of water at deepest point of cross section 15 feet; the navigation is without difficulty, as for the most part there is a good natural tow-path, but the course is tortuous. The old embankments are visible on both sides at some distance from the water edge, giving a cross section of very large discharging capacity when the water surface is 2 or 3 feet higher than at present. From the turn to Akeed to the Kottada calingulah the creek is little more than one-third of the width below, though it is deep in places.

4. The position of the breach you are aware of, it is a little to the west of the calingulah, and at the time of our visit the water surface was 100 feet wide at nearly low tide, and greatest depth of water 20 feet. I had the rise of the tide measured while we were there, it was then a neap tide, and the rise was 3 feet 7 inches, the water flowed round to above the calingulah, the crest of which I found by measurement to be 1 foot 6 inches above the high-tide observed.

5. From the top of the bund there seemed to be still a considerable breadth of water in the lake, but we were assured that we could not take a boat out into the lake; we therefore procured sangadies and embarked on them with the intention of getting to Collaity Cotta if possible. The channel from the breach is very narrow, but a few yards in width, though for some little distance above the site of the old bund, made in January 1873 to raise the water, it was a considerable depth, after this it became very narrow with hardly sufficient water to float the sangadies, till at a distance of less than a mile from the breach we came to a stand-still, after having pulled over the mud for some distance. We had then emerged from the bullrushes which are so thick near the calingulah and were in the open lake with no obstruction to the view for miles. What appeared from the bund to be water was found to be mud, on the surface of which were little pools of water here and there, within sight there was no sheet of water of any extent. From some of these pools the water was trickling towards the

channel we had come up (the only outlet), but it was evident from the appearance of the mud that it was drying up, and even then not covered by tide water; indeed the channel up which we came, which for some distance is confined by the higher ground on each side, could not during the time the tide rises discharge sufficient water to cover but a very small extent of ground.

6. The water in the lake was fresh, and was being used for drinking purposes by the villagers residing on the lake islands, and by the cattle which in large numbers graze there. At the breach itself the water was used for drinking, and we used it for making tea while there, and some 2 miles below the calingulah in the Uppateru we observed that the water was being raised to seed beds. It is evident, I think, that the bed of the lake has risen considerably of late years, that it cannot be effectually drained without the excavation of a system of channels, and that there is nothing to fear from the influx of salt water.

7. We held lengthened conversations with the Tahsildars and ryots of the villages both in the lake and near it. They all said that nothing was to be apprehended from the salt water, that no masonry work for the purpose of holding up water was needed; that it was not desirable to drain the lake altogether, as it could then be difficult to obtain water for men and cattle during the hot weather, and that they wished to lower the surface of the lake during the monsoon months and eventually to cultivate greater part of the bed with rice.

8. It does not appear that much can be done to extend cultivation within the lake at present. I understand that the supply of Godavery water by existing channels would not allow of such extension now, and in the Kistna we have thousands of acres which have a prior claim to supply, and which we are not able to take up for want of funds; but it is very desirable to keep the surface of the lake as low as possible during the irrigation season, as the drainage of the surrounding lands is seriously interfered with by the lake surface being high.

9. Having discussed the subject for two days while we were in the neighbourhood, and having obtained all the information we could from those most interested, we came to certain conclusions which I subjoin, and which I think will, after what I have said above, need no further explanation.

(1.)—That salt water does not enter the lake to any appreciable extent.

(2.)—That there is no necessity for draining the lake to any greater extent than it is at present drained by the breach during the hot weather.

(3.)—That it is desirable to lower the surface of the lake during the irrigation season, in order to provide for the better drainage of the irrigated lands adjacent to the lake, especially those in the Gudiwada taluq of the Kistna Delta.

(4.)—That the proposed extension of the calingulah, with the addition of self-acting sluices, would have little effect in lowering the surface of the lake unless it was of very considerable length, and the escape channel below into the Uppateru (about 1 mile in length, at present of very insufficient dimensions) were widened to a corresponding extent.

(5.)—That such a work, owing to the high price of materials at the site, would be extremely expensive.

(6.)—That the re-opening of some five or six of the old breaches in the Colair bank, within 2 miles to the west of Kottada calingulah, would effect all

the improvement necessary to the lake for many years to come, the time for any considerable extension of cultivation in the bed of the lake not having yet arrived.

10. The breaches proposed would discharge into a branch of the Uppateru which runs to near Allapad, a village about 2 miles west of the breach; one was opened here in 1864, and apparently in former years breaches were customary here; they are shown on the printed atlas sheet.

11. If you approve of the suggestion to open new breaches, I propose to make the cuts before the water rises in the Colair.

Submitted for the consideration of Government with reference to G.O., No. 434, of the 17th February 1876.

The Superintending Engineer, Kistna, is of opinion that the construction of a powerful escape weir with under sluices at the outfall of the Colair lake into the Uppateru would be costly, and would not produce results commensurate with the expense.

Major Hasted practically advocates the first of the two methods* of lowering the water in this lake, *viz.*, increasing the capacity of the openings by which the water finds its way into the river, and he does this on the ground that tidal water extends but a short distance into the lake and that this water is not salt.†

* Mentioned in paragraph 39 of Inspection Notes, dated 7th May 1874. Proceedings, Madras Government, 29th September 1874, No. 2,732.

† It was not supposed to be so and the exclusion of salt water was not therefore a reason for building a weir, which was intended only to reduce the water level above it.

The undersigned thinks that a decision as to the ultimate arrangements may, under the circumstances brought to notice, be postponed for a time, and that in the meantime there can be no objection to the opening of the several channels to the west of Kottada calingulah as proposed by the Superintending Engineer.

2. The main question which was really of great importance, *viz.*, that the lake should not any more be bunded but be allowed to drain freely, has been settled by Government, and the present reference does not affect this question.

3. It will be desirable as soon as this can be conveniently done to have a complete map of the levels of the lake bed prepared. These levels will probably indicate that in particular localities important improvements will be feasible at a small cost, and besides it will be desirable to determine at an early date the position and dimensions of the waterways which should be left open for the passage of the drainage which enters the lake from the uplands* to the north.

* About 2,000 square miles.

(Signed) JOHN MULLINS, Lt.-Col., R.E.,
Chief Engineer for Irrigation.

No. 168. Order thereon, 10th June 1876, No. 1,442.

IRRIGATION, No. 12 to 14.

His Grace the Governor in Council considers that the first step to the formation of an opinion as to the improvements

which may be feasible is the preparation of a map of levels of the bed of the Colair lake, and the Superintending Engineer will accordingly take measures for obtaining this information.

2. The design and estimate for the weir which was in G.O., No. 434, of the 17th February 1876, ordered to be prepared will probably not be required, and should at any rate be postponed.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following :—

No. 69 W.

No. 203. MEMORANDUM.

The following observations on certain works in the North Arcot district, which were inspected by the Chief Engineer for Irrigation in March last, are submitted for the information of Government.

Poloor Tank.

2. *Supply Channel*—Head works.—The flood embankment in connection with the right wing of the dam across the Cheyair requires raising at and near the junction with the masonry. The revetment below the left wing has been built at too steep a slope, and some of it has fallen. At the foot of this revetment an apron about 9 feet wide should be laid to prevent scour, which would undermine the foundations. As a rule revetments, along the face of which there is a current, need such protection.

Head Sluice.—No shutters were visible : they are probably kept at a neighbouring village, but it is doubtful whether under that arrangement they would be found in their places when required, and should there be any difficulty on this point, it will be better to suspend them in their places at 2 or 3 feet above the silt, so that on the occurrence of a fresh they may be readily adjusted to the requirements of the circumstances.

Channel.—There is a good deal of silt in the first 200 yards or so, and the channel is very crooked.

First Drop.

At about three-fourths of a mile from the head there is a drop, the wings of which have been extended with rubble stone in chunam.

Under Tunnel.

At about $1\frac{1}{8}$ miles there is an under tunnel out of repair, and a palmyrah aqueduct has been put up alongside for conveying tank water to fields to the right of the channel ; the requisite repairs should be carried out before the next irrigation season, and prompt attention should be paid to such matters generally. A short distance below this a bowry or square well was being excavated immediately behind the right bank ; unless carefully revetted it may be a source of danger to the channel, and it is a work which should have had the District Engineer's concurrence as to the details of the arrangements.

Second Drop.

At $1\frac{1}{2}$ miles or a little lower down there is a second drop round which water has passed to the left, the ground being low. A stop bank is required, and this should be carried clear of the nunjah to ground above M.W.L. in the channel. Not far below

this the bund of a tank comes up to right bank of channel; the bund is in very bad order, and the escape stands well up above the bund. The repairs necessary should be attended to.

Third Drop and Head Sluice.

At about 2 miles there is a third drop on the channel and a head sluice for the supply of a tank lying a short distance below. Both works are modern and are not well designed to suit the circumstances. The wing returns of the drop are too short, and the sluice needs water wings in rear.

First Surplus Calingulah.

At about 3 miles, opposite to the remains of a bridge or regulator of some kind, there is a small calingulah with seven upright stones of which the crest would seem to be high enough, without any damming thereabove, to allow of a full supply passing down the channel. The over-fall is 4 feet and the apron needs early repair. The wings are about 6 feet above crest. The discharge is into the tank which is supplied by the head sluice at drop No. 3. It appeared doubtful whether the dimensions of this surplus work are adequate.

Second Surplus Calingulah.

At the north end of the same tank and apparently discharging into it there is in the channel bank a small calingulah of about 9 feet clear waterway and with a sluice vent. Some indifferently executed new stone revetment has been put up at the front wing returns. Here also there was formerly a bridge or regulating work on the channel. Another tank lies below the channel to the right, in continuation of the tank above-mentioned. About half a mile further down there is a sluice the design of which had no relation to the conditions of the site. It will be well to remove the upper 3 feet of the front and rear walls and to slope the earthwork of the bank properly. Hereabouts the channel bank is revetted on the interior slopes in an inconsecutive sort of way, and the object of the revetments is not apparent. Some turfing has also been done, which for want of rain has been hitherto a failure. Bushes were not cleared away before the turfing was done, and this should have been attended to.

Under Tunnel.

A little further down there is an under tunnel which looks to need repair; the design of the east wings is inappropriate. The channel is here double banked.

A little lower down there is a patch of new revetment on the inside face of the left bank. It would appear as if the channel bank had here been breached by accumulation of water behind the left bank, and if so a revetment is useless, and an inlet is what is wanted.

The channel then enters a considerable cutting, and is crossed lower down by a bridge of about 12 feet span on the Poloor and Nachinteracoil road.

Provision for upland drainage.

This supply channel evidently intercepts a great deal of drainage from the country lying above it, and the means of disposing of surplus are clearly inadequate. What the area of drainage intercepted is does not appear from the atlas sheet, as many tanks lying near the channel are not marked thereon, and the exact line of the channel cannot in their absence be laid down, but it seems to be probable that this area is not less than 15 or 16 square miles, and if so about 2,500 cubic feet a second is the amount of surplus to be got rid of. Apparently the channel should be

capable of carrying 4 feet of water ordinarily, and the crest of the surplus weirs should be at that height above the bed (after such adjustment of its slope as may be found desirable). The maximum water-level should not exceed 6 feet above the bed, as with that depth the velocity will be as great as the soil will stand, and the corresponding height of the banks should be 9 feet above bed. Consequently the depth of water to pass over the surplus weirs will be 2 feet, the discharge per foot $9\frac{1}{2}$ cubic feet a second, and the length required on the above supposition 263 feet, of which about 34 feet exist. The additional weirs should be so placed as to discharge into the several tanks the supply of which has been intercepted, and the lengths should be fixed approximately with reference to the areas draining into the channel in their neighbourhood. The sites for the several weirs may be selected, within the limits thus indicated, where the soil is most suitable, and the ground level as near to 4 feet above channel bed as may be.

An inlet in the left bank where the channel is double banked has already been intimated to be necessary by way of supplementing the under tunnel.

Mile and Furlong Stones.

Mile and furlough stones are necessary; first, for convenience; 2ndly, as references for levels; 3rdly, for the specification of work to be done. The levels of all masonry works also should be noted thereupon.

Tank.

Surplus Weir.—This has been lengthened from 59 feet to 250 feet, additions having been made at both ends of the old work. The drops are 3 feet on to first apron, 3 feet on to second apron, and 2 feet on to the lowest apron, which is of dry rubble. The stone used for the latter is much smaller than it should have been, especially as there is an abundance of large stone close at hand. It seems probable that after a little while a third masonry apron and a fourth drop will be necessary, the soil in rear of the lowest apron not being apparently hard, and the fall being considerable. The weir had just been whitewashed to obliterate the scribbling of herd boys and others, and so what the work was really like was not to be seen. The wing revetment has no backing, and the soil being cotton, its stability is not likely to be satisfactory.

New Sluice.—The design of the new sluice near the south end of the bund is faulty and not well adapted generally to the circumstances of the site. When the plan was submitted with the estimate for the tank repairs and improvements, the modifications required were noted thereon, but it appears that the work was carried out in anticipation of sanction, and consequently the defects were not remedied. It will now be necessary to construct a platform at or above F.T.L., which may be done either by throwing an arch across between the front wings so as to give a platform 3 feet wide as a maximum, or the same object may be attained by placing beam stones across in lieu of an arch, and this latter arrangement the Range Officer considered could be more readily carried out.

The earthwork of the bund has been raised 4 feet, and the revetment 3 feet. The old revetment is not in very good order, and the new work has, it is understood, no backing, and is otherwise not up to a reasonably good standard for such work, the stones not having been well packed and there being considerable spaces which ought to have been carefully filled in. The gibbet stones of the sluice near the north end of the bund are much below F.T.L., and if the head of the sluice be efficient a platform,

at F.T.L. whence to regulate the sluice should be provided. At the north end of the bund there is a calingulah, the crest wall of which has been raised nearly to the tops of the upright stones. Its length is 80 feet. There is a sluice under the right end and a high level channel in connection with the left end.

Gauge at Sluice.

A gauge at the low level sluice is requisite; the zero to correspond with the sluice sill.

Baghmapett Tank.

3. The tank is said to have been repaired thirty-six years ago. The bund wants clearing, a good deal of raising in places, and the soil should be taken from the bed. The revetment and a sluice also need repair. There is no surplus weir; a pavement will meet the requirements.

Maddemangalum or Yelavady Tank.

4. A short distance from the bifurcation of the Vellore and Arnee roads there is a rather large tank, the greater part of which lies to the east of the latter road, but a portion of the bund and a calingulah are to the west of the road. The bund is in very bad order and needs thorough repair.

Seesamangalum Tank.

5. *Supply Channel* from Secar.—Head Sluice.—The shutters have rings at the top, and want two or three holes at intervals of a foot or so for the adjustment of the shutters when the river is in fresh, so that the full supply level in the channel may be allowed, but not exceeded. What this F.S.L. is to be should be marked on the rear wings (Circular No. 32). The front wing revetments of this sluice are indifferent. Gauges should be placed above and below the sluice.

The *Syphon tunnel* to carry irrigation water under the channel just below the head sluice is not in use, the masonry work having given way. The cistern drop walls are a good deal too low; their crests should be at the proper level of the small channel bed, and at the present level of the upper one this bed would be cut down and the soil would be washed into the tunnel and probably choke it.

Aqueduct, 1st Mile.—The masonry shows several small cracks, and the settlements to which they are due should have been prevented by careful construction in the first instance, for cracks even though of no importance in themselves often lead to deterioration, especially if tree seeds lodge in them.

Inlet, Right Bank.—This is just below the aqueduct, and being formed of dry stone revetment and paving, the latter at a level considerably above F.S.L. in channel, is not likely to stand long. Either the water will have to be run down a paved shoot which, if formed of carefully packed stone, might be stable; or it will need to be dropped over a crest wall on to a masonry apron, and then masonry wings will be required.

The Jaghiredar's aqueduct, which was built without permission and on a design which obstructed waterway, has been dismantled; if he wishes to reconstruct it he should be furnished with an appropriate design and estimate of quantities.

Tank.

The channel is rocky throughout. There are a rough stone escape and a masonry calingulah at the north end; the former is not suitable to the site, the overfall being considerable.

There are some curious ends of bund hereabouts, and there have been two considerable changes made in the alignment of the bund at some former period.

There is another calingulah further south, which being situated at a deep part of the tank, it is intended to close and to substitute a large weir at the north end. It appears to be worth consideration whether it would not be better to close the gap by which the water from the escapes in the north return bund passes, and to construct a weir at the high ground beyond, especially if the soil there be found to be hard, and room enough can be obtained without much excavation in excess of the quantity of soil necessary for filling the gap.

Cheyair Anicut Irrigation.

6. *Anicut.*—This did not suffer much from the flood of 1874, although the trial was a severe one, for the water rose to 9 feet above the crest, and the springing line of the bridge arches is very much below that level; indeed the arches must have been entirely submerged. The rough stone apron has been a good deal disturbed, but very little of the stone has been lost. It was intended to build another retaining wall at the edge of a cut stone apron (long stones) which appears to have been an addition to the original work, but on further consideration it has been deemed unnecessary to incur the expense, as a little underpinning will make this apron quite sound, and it has stood very well for a good many years. In repacking the rough stone apron it will be better to place its surface a foot or so lower than before at the junction with the masonry apron, and a foot lower still at the outer end. The stones should be packed with their length nearly vertical or at right angles to the slope of the apron.

7. *Main Channel.*—The spoil banks were originally very irregularly thrown up, and as a consequence they are at present* incapable of being used as a bridle path, added to which the wash from them into the channel is considerable. Advantage should be taken of the present opportunity, afforded by the extensive clearances in progress, to bring them into section on the inner slope and top, and the drainage of the latter should be away from the channel.

* March 1876.

The channel apparently was not in the first instance cut to a full and regular width, or to the proper depth, and a good deal in the way of improvement of this kind was being carried out as repairs. It would have been better to provide for this under new works by a separate estimate, because then some points of importance would more readily have come under notice; and moreover the repair funds of the district are not adequate to the carrying out of anything more than very petty improvements which are not worth separately estimating for.

This channel receives the drainage of a considerable extent of upland, and more or less silt is thus brought into it. It is necessary that the area draining into the channel in the several sections or miles should be computed, and due provision made for the discharge of surplus. The arrangements of such works will depend upon the difference to be allowed between ordinary F.S.L. and M.W.L., which should not exceed 2 feet. There were several surplus weirs; but a Range Officer, understood to be Mr. Bevan, blocked them up, and so has left the channel without even the small and probably very inadequate safe-guard which it once possessed. The walls of these weirs should at once be cut down to ordinary F.S.L.

Where the channel water rises above ground level, and where there is no right bank it will, it is thought, be generally desirable to prevent submergence of lands

where cultivated or in occupation by forming a small bank, about 1 foot above F.S.L., with material obtained from clearing; drainage can then be admitted at fixed points only, and at such points as may present favorable conditions, care being taken that the spaces reserved for such admission are in all cases of ample dimensions, so that there may be no considerable depth or rush of water.

The *Mookoor tank* is the first into which the main channel runs, and thereafter it enters and leaves a succession of tanks.

The *Chengadoo large tank* lies immediately above the channel, and discharges into the latter just below a bridge. The water passes down the channel into the *Chengadoo Naickenary tank*, which latter at the lower end has a weir which has been lengthened from 30 to 70 feet. It should be ascertained what the drainage area is, and whether the means of disposing of surplus are adequate; if not a weir just below the bridge should be given if the discharge of surplus at that point will do no harm to cultivated lands below; or it may be desirable to discharge the surplus of the large tank at the east rather than at the west end.

The *Coviloor tank* has been much enlarged. It has a small weir at the north end, and at the south end there is a comparatively new sluice of indifferent design.

Designs of masonry works of this part of the country.

8. The designs of most of the masonry works of this part of the country are bad, and they are made worse by the way the earthworks are joined to them. There is much need of exact sections of the ground and banks on which such works have to be built, or with which they are to be connected, and the water-levels should always be duly considered.

Bifurcation of Main Channel.

9. The main channel ends about 2½ to 3 miles west of the Arcot and Wandiwash road. The right branch falls into the Poorasay tank, over the bund of which that road passes, and the left branch runs nearly on the water-shed between the Cheyair and the Cheaur to the Tetry tank.

Poorasay Tank.

10. An estimate had been framed for raising the F.T.L. about 2 feet and the bund 4 feet. In 1864 the small escape under the north tunnel at the south end of the bund was much crippled by raising a body wall 3 feet high on a line with the face wall of the tunnel. Had this wall been placed 3 or 4 feet distant on the tank side, it would have left the discharging power of the escape with a given depth of water passing over unimpaired, and, if this escape be retained, the wall should be so removed. The evidence is not very clear as to what was the former full level of this tank, and it is said that the upright stones at the tunnel escape have been buried in the crest wall. However this may be, it is probable that the former M.W.L. did not exceed the present F.T.L., and that the alteration of the escape so as practically to raise the M.W.L. considerably should not have been carried out without at the same time altering the level of the bund to correspond. Moreover alterations having for their object a material increase of the capacity of a tank are not works properly chargeable to ordinary repairs, but when considered desirable they should be brought forward for sanction as new works, and should be supported by proper information. The intended arrangements of the work under execution in anticipation of the sanction of the estimate, with a view to the safety of the tank which had been

seriously endangered during the floods of 1874 owing to the inadequacy of the escapes, which inadequacy had been enhanced by the alterations above referred to, being under the circumstances more costly than was needful, certain modifications were considered desirable, and instructions were given to the District Engineer at once, in order that the work might be carried out accordingly. The estimate which had been submitted was returned shortly afterwards for revision.

No. B, dated 21st March 1876, *vide* Appendix.

The floor of the north tunnel escape and the corners of the abutments on the lower side require underpinning, and an additional apron (rough stone) about 12 feet wide should be added, the surface being placed 1 foot below that of the floor.

There is a road tunnel a little further south which acts as an escape and also as a head sluice to a high level channel. Its floor is about 1·77 feet below present F.T.L. The means of disposing of surplus require to be very largely increased, and the additional escape may, it is considered, take the form of a road dam, and it should be of sufficient length to restrict M.W.L. to 2 feet above F.T.L. The District Engineer was informed that an estimate for further raising the F.T.L. may be prepared and submitted for sanction on its merits, but that the work to be done at present should be confined to that necessary to make the tank safe with its present F.T.L.

In reconstructing the revetment a good backing should be provided, and the slope should be 1 to 1, as then the quantity of earthwork required will be much reduced, and this is of importance, seeing that soil has to be brought from a distance, the ground in rear of the bund being cultivated, and the tank water seldom falling low enough to allow of earth being obtained from the bed.

Tetry Channel.

11. This channel runs through several tanks, and it seems to be probable that its share of the supply is less than it should be; for while the Poorasay tank which is under the other branch always gets an abundance of water, the tanks under the Tetry branch are not well supplied. With gauges at the heads of the branches and information as to their discharging capacity with given depths of water, the requisite detailed instructions for the management of the regulation may easily be drawn up.

Veerapaukum Tank.

A new sluice was built in 1874; an old pattern which is unsuitable to the circumstances was adopted.

Nurmapullum Tank.

This has been recently repaired and is in fair order. The villagers complain of scarcity of water, and appear to interfere with the supply to tank slower down by bunding the regulating weir at the off-take of the channel from the tank.

Kurumboor Tank.

This was it is said repaired in 1870-71. The earthwork is in fair order, but the revetment is in a mess owing to its having no backing.

Melmar Tank.

The supply channel for this has a head sluice which has been built in a surplus weir of the tetry channel, and has entirely closed it. This was done in 1874. The design of the sluice is bad, the work indifferent, and apparently the chunam was not good. The proceedings were altogether improper, and sanction to the estimate must

have been given on inadequate information. Rear water-wings and a lower floor $2\frac{1}{2}$ feet below the sluice floor are necessary. Just above the sluice there is a set against the bank which can be remedied by cutting away a little decayed rock and by revetting.

Tetry Tank.

* Of that name.

This is the upper tank.* The bund is in fair order; revetment middling. The wings of the regulating weir at the north end of the tank, and there is no other escape, are several feet lower than the bund. The water passes thence into the Tetry tank east of the road, and the channel turns at right angles after passing the road, the bank being revetted. Probably a pavement is necessary over the bed of the channel from the road tunnel to the end of the revetment, as the action of the water must sometimes be rather violent.

Sketch Map and information required.

12. There is a rough sketch map showing the tanks connected with the Cheyair anicut channels and those in the neighbourhood which have not as yet been supplied therefrom. This map, imperfect as it is, is of considerable value, but what is much wanted is a connected set of levels of the whole system of irrigation, and then a complete knowledge of the circumstances and requirements of the several parts of the system. As a foundation for the investigations, accurate general levels are necessary, and arrangements have been made for obtaining these. Formerly levels were neither checked, connected, nor properly recorded, and the frequent changes in the department from large divisions to districts,* then to smaller divisions,† and then again to districts‡ have rendered it very difficult to find out what has become of those technical records which at some time or another must have existed.

* 1857.
† 1863.
‡ 1872.

The levels of all the tanks—F.T.L. and level of lowest sluice sill—which are now supplied, or which it may be proposed to supply of the several sections of the main and branch channels are necessary as an essential preliminary to the proper management of the works, and to the determination of the way in which further investigations for the improvement or efficiency of particular parts of the works should be carried out. As soon as the general levels have been run and the values of bench marks determined, these levels of the Cheyair anicut system should be proceeded with, and at the same time such surveys as will allow of a fairly accurate sketch map being drawn up should be made, unless the Revenue Survey should be able to afford the information required. Applications from villages to be supplied from the anicut are frequent and are made by villagers of the Chingleput as well as the North Arcot district, so that it is probable that a material extension of the usefulness of the anicut will yet be found feasible. The accounts of past expenditure and of revenue resulting therefrom have yet to be compiled, and as yet there has been no return prepared throwing any light upon the subject. The results shown will be of value, not only as exhibiting the value of these works, but as a guide to a decision as to whether the Cheyair can be further turned to account as a source of irrigation for lands in South Arcot on the one hand, and by the construction of another anicut below the junction of the Sreaur near Mambaukum, as has been strongly urged.

Water-supply of Cheyair.

13. Instructions were issued some years ago for a careful examination and analysis of the water-supply of the Cheyair, as deducible from the registers kept at the

anicut, to be made. These instructions, owing to frequent changes in the charge of the district, appear for a time to have been lost sight of, and the present District Engineer has had much to occupy his time and attention since he took charge some three years ago, but he has promised shortly to make an opportunity for doing this necessary work not only for the Cheyair but for the Palar also.

Dusi Mamdur Tank.

14. The way in which the repairs to the low level sluice with improved arrangements at the head are being carried out will do very well. As a rule, it is desirable to have wider tunnels for the sluices of large deep tanks; but, as the flooring and the side walls, where lined with stone, were in good order, it was not necessary in this case to make any alteration. As the outlet from the tunnel into the rear cistern is low, a ventilator 8 or 9 inches in diameter may with advantage be placed a short distance above the cistern wall, the mouth being placed 2 or 3 inches above the rear slope of the bund.

Special care should be taken to rake out the joints of all brickwork which is to be plastered. The failure or falling off of plaster, which is so common, is due to the neglect of this essential preliminary, and this raking out of the joints should be done a few days after the brickwork is built, and then it can be easily and effectually performed.

Disposal of surplus.

With regard to the proposed rearrangement of the surplus works (calingulahs) of this tank, it appears that the conditions are as follow :—

1*st.*—It is said that the south weir crest is 5·80 feet below proper full tank level—a level, however, which has not at least in recent years been attained. That similarly the crest of the northern weir is about 2·75 feet below F.T.L.; that the water in 1872 rose to 7 feet above the crest of the south weir, or to 1·20 feet above F.T.L.

2*nd.*—The full length of the south weir is 234 feet.
,, effective do. do. is 133 ,,
,, full length of the north weir is 119 ,,
,, effective do. do. is 89 ,,

There being no information as to the tail water levels in the flood of 1872, any accurate calculation of the actual discharge then is impracticable, but from a rough calculation which has been made it appears that this discharge was—

Between stones, south weir, cubic feet a second		... ...	4,134
Above do. do.	do.	... ...	1,034
Between stones, north do.	do.	... ...	1,646
Above do. do.	do.	... ...	286
		Total cubic feet a second ...	7,100

The area of the catchment basin is said to be 85 square miles, and the above discharge is therefore equivalent to 2·46 inches from the whole area.

3*rd.*—On the other hand Ryves' formula with a co-efficient of—

400 gives a discharge of ... ... 7,732 cubic feet.
450 do. do. of ... ... 8,698 ,,

equivalent to 2·87 and 3·23 inches respectively from the whole area. It does not appear that the larger of these quantities is less than should be deemed possible, and

in order to err, if at all, on the safe side, the maximum quantity coming into the tank may be assumed to be 9,000 cubic feet a second.

4*th.*—A tank of this size must act to a material extent as a flood moderator, and it is very probable that some of the difference between the discharge as calculated from the depth on the weirs and by the formula is due to this circumstance. On the atlas sheet the area of the tank appears to be about $5\frac{3}{4}$ square miles, or 17·811 millions of square yards, so for every yard of depth this area would absorb 17·811 millions of cubic yards, and this quantity in a day represents 1,855 cubic feet a second. It follows then that without much risk of error 2,000 cubic feet a second may be assumed to be absorbed in raising the tank above the F.T. level one yard.

5*th.*—According to these data then 9,000 — 2,000 = 7,000 cubic feet a second would be the maximum quantity to be disposed of if M.W.L. were to be fixed at one yard above F.T.L. It has been already mentioned that the water rose to 7·0 — 5·80 = 1·20 feet above F.T.L. in the flood of 1872, and therefore a maximum water level so fixed would be 1·80 feet higher than the maximum level of that year.

6*th.*—The full length of the two escapes would, with the upright stones removed, be effective, and would be 353 feet — $\frac{7,000}{353}$ = 19·83 cubic feet a second per foot of weir, which with a clear over-fall would correspond to a head of 39 inches. There would be a clear over-fall at the south weir with a crest at any level at or above 1·80 below F.T.L. There would not be a clear over-fall at the north weir with the crest at F.T.L. Assuming the full discharge to require 4 feet of water on the aprons, (first) it remains to be seen what area of sluice vent would reduce the M.W.L. from $3\frac{1}{4}$ to 3 feet above F.T.L., and it is thought that, if circumstances will allow, it will be better to put the sluices at the north rather than at the south weir.

	The south weir with 3 feet going over will discharge 234 × 17·458 = ...	4,085 cubic feet.
The tail water 1·25 feet above crest.	The north weir under similar conditions will discharge (119 feet).	1,886 ,,
		5,971

leaving 1,029 cubic feet a second to be disposed of by sluice vents. The head available is 3 — 1·25 = 1·75 feet, and V may be taken as $6\frac{2}{3}$. The area of opening required will then be 154 square feet. Also the height of the crest wall being 2·75 feet, if vents 4 feet wide be provided, each vent will measure 11 square feet, and 14 will be the number of vents. In this position open vents with self-acting shutters working on a horizontal axle would be unobjectionable, for the leakage would be utilized; and if the shutters be designed to open with the water at 1 foot above F.T.L., there will be plenty of margin to ensure opening before the M.W.L. is reached.

If the level of the tail water should approximate to 3 feet rather than 4 feet above apron, the discharge over the north weir will be 2,053 cubic feet, and through the sluices 1,287 or together 3,340 cubic feet against 2,915 as before calculated.

The conditions* prescribed for the vent shutters will be nearly satisfied if the lower half be made 13·3 and the upper half 19·7 inches.

* To open at 12 inches above F.T.L.

OOTACAMUND,
27*th April* 1876.

(Signed) JOHN MULLINS, Lt.-Col., R.E.,
Chief Engineer for Irrigation.

To the Secretary to Government, Public Works Department.

No. B.

Memorandum of Specification for reconstructing revetment of Poorasay Tank.

THE alignment of the new revetment should be laid out as straight as possible or with curves as flat as possible. This may best be done by putting up bamboos at 15 or 20 feet intervals to denote the toe of the revetment at top of foundations.

2. The top of the foundations will for the deeper part of the tank be at 17·77,* or 6 feet below F.T.L., and the foundations will be 3 feet deep and 3 feet wide, the lower half being 1 foot in advance of the upper half.

* On datum of Tank sections, dated 10th August 1875.

It is desirable that the toe of the revetment should be about 6 feet inside the line where the present flat slope of the bund cuts the 17·77 level; but at a bund of which the slope varies much, no fixed specification can be made as regards this point.

3. The excavation for the foundations should be taken out as shown, the cutting below 15·27 being exactly 3 feet wide. If, as is not improbable, the soil at bottom of trench should be found to be soft, a firm base for the foundations must be prepared in the following way:—The bottom of the trench to be covered with small stone in lumps of about the size of the closed fist (3½ × 4½ inches) in a single layer, and this stone to be driven down with heavy rammers not more than 4 inches in diameter; a second layer to be then laid down and similarly rammed down, and similar layers to be added until no more can be driven down.

Then the lower 18 inches of the foundation to be laid with carefully packed stone, all the interstices being filled in with small stone and rammed in tight. Next the upper half of the foundations will be laid in the same manner; the soil to be replaced in the trench in front in 6-inch layers and thoroughly consolidated with the heavy rammers above-mentioned; also at the back of this part of the foundation small stone to be rammed into the soil to make a firm base for the revetment backing.

4. The revetment stone is to be laid with the joints at right angles to the slope, and the top of the foundations is to be prepared accordingly, something like the skew back of a bridge to give the revetment the proper cant.

5. The backing to the revetment will be 1 foot in thickness: it will be composed of small stone 2 to 2½ inches in diameter, coarse gravel, and enough gravelly soil to bind the coarser materials together. It is to be mixed, watered, and thoroughly consolidated with rammers in the way that concrete is laid down, enough water being added to bring moisture up to the surface when beaten with the rammers. The backing and revetment are to be carried up together and equally, the backing being filled in and consolidated directly after each coarse of revetment is laid and before a second coarse is put down.

6. The revetment is to be 2 feet in thickness (measured at right angles to the slope). It is to be built of stone of as regular shape as may be procurable.

(*a.*)—All stones must be laid with their length perpendicular to the face.

(*b.*)—As many stones as possible should be 2 feet in length, or, in other words, through stones.

(*c.*)—Every fifth stone at least must be a through stone.

(*d.*)—None of the face stones must be less than 18 inches in length.

(*e.*)—Every stone must be so bedded as to be firm and not liable to move when trodden on. This will be the case if small stone be used as packing where necessary.

(*f.*)—There must be no open spaces anywhere of more than an inch in width; all spaces in the face work must be filled with small stone driven in with the blunt end of crowbars; not merely bits of stone placed so as to hide the cavity and capable of being picked or kicked out, but stones fairly filling the cavities must be used and must be driven in so as to be with difficulty picked out with a crowbar.

(*g.*)—By properly ramming the backing up to the back of the stone and into all the irregularities of the rear face of the revetment a perfectly firm support will be afforded.

and the revetment will serve its intended purpose and will require no repairs for very many years.

(*h.*)—The old slope of the bund at the toe of the revetment is to be made up to its original form where temporarily removed for laying the foundations, and this is to be done as soon as the revetment has been built up to the required level. This fore-shore is then to be pitched (covered) with stone which is to be rammed in; the irregular stone which may be useless for the revetment will do very well for this pitching which is intended to prevent the soil which covers the revetment foundations from being washed away.

(*j.*)—All earthwork required to make up the bund to section, behind the revetment and backing, must be rammed perfectly hard in their layer.

(*k.*)—When the revetment and its backing and the earthwork in rear have been completed to the section intended, a small side ridging of earth as shown should be placed over the revetment and backing to prevent any drainage from the road finding its way into the revetment or behind it. The surface of the road should be 3 or 4 inches higher at the side ridging than at the rear edge, so that all rain water may flow to the rear.

7. When the flat slope of the interior comes high up the bund, and when the tank is comparatively shallow, the top of the foundations of the revetment may be higher than the level shown in the working section. There may be places also where the foundations may have to be placed lower. Whatever the circumstances, the alignment of the revetment should be so made that the several tanks may fit well together. Thus for every foot that the foundations may be placed lower they must be advanced 1 foot to the front, and for every foot higher they must be retired 1 foot towards the bund.

CAMP AT PENNAGUR, (Signed) JOHN MULLINS, Lt.-Col., R.E.,
21*st March* 1876. *Chief Engineer for Irrigation.*

To the District Engineer, North Arcot.

No. 204. ORDER THEREON, 13th June 1876, No. 1,462.

IRRIGATION, No. 15.

THE foregoing memorandum will be communicated to the District Engineer, North Arcot, for information and guidance.

2. The observations of the Chief Engineer for Irrigation show that the past management of some of the Irrigation Works admits of improvement, and that there is a good deal to be done for the safety and efficiency of the works, especially in the very important matter of providing adequate means of disposing of drainage.

3. The improvement and extension of the irrigation under the Cheyair anicut will, it is hoped, make steady progress when the levels needed to obtain proper data on which to work have been taken. The accounts of past expenditure and of the revenue derived from these works are necessary to a correct apprehension of their value, and as a guide to the determination of other proposed schemes for further utilizing the Cheyair as a source of irrigation.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following papers :—

No. 209.	From Suptg. Engr., Coimbatore, No. 122,				29th February 1876.	
No. 209-A.	To	do.	do.	„ 3 C.-I.,	27th March	„
No. 209-B.	From	do.	do.	„ 1	1st April	„
No. 209-C.	To	do.	do.	„ 8 C.-I.,	28th „	„
No. 209-D.	To Chief Engr., P.W.D., Mysore,			„ 33 M.,	28th „	„
No. 209-E.	From	do.		„ 945,	10th May	„
No. 209-F.	From Suptg. Engr., Coimbatore,			„ 21,	15th „	„

No. 68 W.

No. 209-G. *Note by the Chief Engineer for Irrigation.*

In G.O. of the 26th May 1875, No. 1,471, an estimate of Rupees 2,500 was sanctioned to protect valuable lands on the right bank of the Cauvery near Humpapooram from further erosion, and in the note on this estimate it was remarked that in some respects the information afforded by the Superintending Engineer, Coimbatore, was insufficient.

2. In G.O., No. 318, of the 5th February, the report of the Superintending Engineer on the results of the work done in 1875 was reviewed, and it was noticed that the sketch submitted was too rough to allow of a correct idea of the circumstances being formed. It was also remarked that without more complete surveys and a clearer demonstration of what is intended to be done on the right bank, there will be considerable risk of any prejudicial changes on the left* bank being attributed to the operations carried on under the orders of the Superintending Engineer.

* Mysore Territory.

3. With his letter of the 29th February last, the Superintending Engineer forwarded an estimate of Rupees 1,250 for improving the groynes put up the year before, and for nanal planting, &c., and he was informed that before any further expenditure could be sanctioned a proper survey would be required and instructions in connection therewith were given.

No. 3 C.-I., 27th March.

4. In his reply to this communication, the Superintending Engineer stated that the work to be done was emergent, the river admitting of nanal planting only in February and March, and that something under 850 Rupees had probably been expended up to the end of March. He also intimated that the right bank a little way above the Honully river and the left bank entirely were in Mysore territory, and he could not, therefore, submit the information based upon a survey and levels which had been called for, and he added that could this information be given it would be of no use, as defences could be put up only to prevent further erosion near Humpapooram, and that a proper alignment could not be laid down, only one side of the river being under the Madras Government. The Superintending Engineer did not apparently

No. 1, 1st April.

understand his instructions, for, of course, the proper alignment of the river and the best alignment of the particular part of the right bank which was under treatment were determinable from the circumstances of the river independently of any work which might be required and might or might not be undertaken in Mysore territory. The character and results of the defensive works near Humpapooram were capable of being affected by what might be done or left undone in Mysore territory, but supposing that nothing were done there, it would still be proper to ascertain the circumstances of the river and to arrange for the Humpapooram defensive works being properly laid out, and for a definite scheme of work being decided upon.

5. To enable the surveys and levels to be completed as far as might be necessary, the Chief Engineer in Mysore was addressed and the requisite permission obtained,* and it will be seen that the remark at the end of G.O., No. 318, of the 5th February 1876, was not made too soon, and that the Humpapooram defensive works are already considered to be injurious to the Mysore bank of the river, though, as far as the undersigned is able to judge, the idea that they have so acted prejudicially is probably based on a misconception, which will be removed on furnishing the Executive Engineer with a copy of the survey when completed, which should be done.

* No. 33 M, 28th April.
„ 945, 10th May 1876.

6. The survey and sections submitted by Colonel Wilkieson (No. 21, 15th May.) give much better information as to the circumstances than the previous survey and sketch afforded, and show how very rough and incorrect these were. The survey, however, must be extended both up and down the river for at least a mile, and possibly more, to enable reliable conclusions to be arrived at as to what should be done further in the way of defensive works and reclamation, though an alignment, which probably will not be far wrong, may be laid down on the survey as it is, and this has been done by a blue interrupted line, and by pencil lines has been roughly indicated the way in which the nanal planting will probably be most effectively carried out, and the correct alignment worked out to in three or four seasons. The survey as submitted indicates no plan of operations. Nanal planting should not, it is thought, be deferred until February, but should follow the falling water after the November freshes, as then it may be expected that it will become thoroughly rooted while there is sufficient moisture, without artificial watering, a very expensive arrangement, added to which watering is no effective substitute for an abundance of moisture in the soil.

7. On the survey near the lower end a fifth groyne is marked as proposed, but there appears to be no item in the estimate for it, and its intended length and direction have not been indicated. It would seem, moreover, that a groyne in that position would be useless, and that thereabouts the existing line of bank, if on the proper alignment, need be protected only by a narrow strip of wild cane and nanal. If another groyne be necessary, it should be placed some 120 yards higher up, towards No. 4 groyne.

In the estimate there is provision for constructing a groyne at the head of durbah embankment, but this work is not indicated on the survey, and it is not understood what purpose it is to serve. If it is to divert the Honully stream from the point where a small stream is shown as crossing the line of the embankment, unless it be made very oblique it may do more harm than good, and a modussil facing would seem

to be more appropriate than a groyne to afford protection while a growth of wild cane and nanal is established.

8. There is a want of correspondence between the survey and cross sections in some places, *e.g.*, there is a distance of 400 feet on the cross section, and of about 700 feet on the survey between the edge of the channel of the river coloured blue and the bench mark on the left bank, and there are somewhat similar variations elsewhere.

9. The estimate has not been corrected or made clearer with reference to paragraph 4 of this office No. 3 C.-I.

10. In order to the adjustment of expenditure, it appears necessary that the estimate, dated 12th February 1876, should be sanctioned, and the Superintending Engineer should take care that his report on the work of the current year and his proposals for next year are fully and clearly made out. The waterspread in floods should be shown on the survey on the right bank, and if the highest fresh tops the river bank on both sides, which does not seem to be probable, seeing that this would indicate a depth of water of over 20 feet, the water level should nevertheless be marked.

Rupees 1,250.

11. The reclamation up to the blue line will be about 52 acres.

OOTACAMUND, (Signed) JOHN MULLINS, Lt.-Col., R.E,

29*th May* 1876. *Chief Engineer for Irrigation.*

P.S.—An additional letter, No. 25 C.-I., from the Superintending Engineer, written after the letter from the Chief Engineer in Mysore had been communicated to him, is also submitted.

23rd May 1876.

6*th June* 1876. (Signed) JOHN MULLINS.

No. 210. ORDER THEREON, 13th June 1876, No. 1,465.

IRRIGATION, No. 16.
Account.

* Called Miscellaneous in Budget Preliminary Issue.

THE estimate of Rupees 1,250, for defensive works on the right bank of the Cauvery near Humpapooram, is sanctioned under Ordinary Agricultural Works for which no Capital or Revenue Accounts are kept, River Conservancy, and the work will be chargeable to the district repair grant under that head.*

2. This sanction has been registered as shown in the margin.

(a) *Head of Service.*—Irrigation.
Fund.—Ordinary Agricultural.
Class —Repairs.
No. 47-I. of 1876-77.—Defensive works on the right bank of the Cauvery near Humpapooram.
Estimate No. 14 of 1876-77.—Rupees 1,250.
To be carried out by the Public Works Department.

(Signed) G. W. WALKER, Major-General, R.E.,

Secretary to Government.

No. 275. Read the following Proceedings of the Government of India in the Public Works Department, (Account—Irrigation,) dated Fort William, 11th January 1876, Nos. 6—7 A.—I.

Assimilation of system of Public Works Accounts in Madras and Bombay with that of the rest of India, and preparation of Capital and Revenue Accounts of Irrigation Works.

Read again the following papers:—

P. W. D. letter to Secy. to Govt. of Madras, No. 394 A.—G, dated 1st July 1875.
Do. to Secy. to Govt. of Bombay, No. 395 A.—G, dated 1st July 1875.
Despatch to Secretary of State, No. 70 P. W., dated 1st July 1875.

Read also the following despatch from the Secretary of State for India, to the Government of India, dated 11th November 1875, No. 67.

I HAVE received your Excellency's letter, No. 70, of the 1st July last, reporting that the systems of Public Works Accounts obtaining in the Madras and Bombay Presidencies have been assimilated to that in force under the Government of India. This arrangement is one of much importance in relation to the proper administration of the Public Works Department, and especially to that part of it which relates to the record of the financial results of works carried out with borrowed capital.

2. It is a matter of much satisfaction to me that these arrangements have been completed with the concurrence of the Madras and Bombay Governments.

3. The preparation of satisfactory accounts of all Irrigation Works, similar in form to those kept of the canals in the North-Western Provinces and the Punjab, is manifestly very desirable, and it is, therefore, of the first importance that a correct annual statement of all Irrigation Works should be available, prepared upon one uniform system for the whole of India, and I desire that, if it be practicable, such an account should be sent to me in time for presentation to Parliament next session.

4. It can, perhaps, hardly be expected that the first returns upon any approved system submitted for Madras and Bombay should be perfect, but it is more important that the accounts should be rendered promptly and regularly, in a fairly correct manner, than that no accounts should be submitted at all. In view to this end, further prolonged discussions regarding details should be avoided. Difficulties may, no doubt, arise in particular cases, which will, perhaps, require a somewhat arbitrary treatment, as, for instance, where there is no distinction made, in assessing or collecting the land-revenue, between the shares relatively attributable to the land and the water. But it will be much better, under such circumstances, to accept at once that conclusion which seems best, after reasonable inquiry and consideration, than to prolong a discussion which, in its very nature, can only result in an approximate or arbitrary solution.

ORDER.—Ordered that the Despatch read be communicated to the Governments of Madras and Bombay for information and guidance, with a request that it may be stated when a report of the financial results of Irrigation Works in the forms in use in the North-Western Provinces and Punjab, made up to end of 1874-75, or, if that

cannot be done, to end of 1873-74, may be expected. In order to comply with the wishes of the Secretary of State, the returns should be received in this department during next May at the latest.

(Signed) C. H. DICKENS, Colonel, R.A.,
Secretary to the Govt. of India.

No. 276. ORDER THEREON, 17th June 1876, No. 1,500.

IRRIGATION, No. 17.
Account.

IT IS understood that the conference ordered in G.O., No. 3,251, of the 13th November last, to be held at the Revenue Board Office, has terminated its sittings, and the report is awaited and should be submitted with as little delay as possible. In the meantime the following letter will be addressed to the Government of India.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 277. From the Secretary to the Government of Fort St. George, Public Works Department, to the Secretary to the Government of India, Public Works Department, dated 17th June 1876, No. 1,501.

IRRIGATION, No. 18.
Account.

SIR,—With reference to the Order, No. 6-7 A. I., dated 11th January 1876, of the Government of India, I am directed to state that this Government is making the most earnest efforts to meet the requirements of the Secretary of State, and that with this object one of the best Revenue Officers has been selected to work up the information needed, in conjunction with the Examiner of Public Works Accounts. I am to add that all that is possible will be done to ensure the completion of this work as soon as possible.

No. 278. Read the following letter from Colonel C. H. DICKENS, R.A., Secretary to the Government of India, Public Works Department, (Account—Irrigation) to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, Irrigation Branch, Fort St. George, dated Fort William, 25th January 1876, No. 48 A—I.

I AM directed to acknowledge the receipt of your endorsement, No. 2,960, dated 15th October last, forwarding, in advertence to my letter of the 17th September, a copy of the Proceedings of the Government of Madras on the method of making up the accounts of Irrigation Works.

2. In a recent despatch* from the Secretary of State, His Lordship has urged that a correct statement of the financial results of Irrigation Works should be submitted to the Home Government in time for presentation to Parliament next session.

* See copy of His Lordship's Despatch, No. 67, dated 11th November 1875, forwarded separately with Public Works Department Resolution, Nos. 6—7 A—I, dated 11th January 1876.

3. The Governor-General in Council is most anxious that this should be done, and relies upon the Government of Madras to ensure that this department is furnished, by May next, with a statement of the financial results of all important Irrigation Works to end of 1874-75. The results should be drawn up in the forms and in the manner in which the annual Revenue Reports from the North-western Provinces and Punjab are prepared. And an abstract of the results should be rendered in somewhat the same form as is used in the accompanying volume,* the headings being of course modified to suit the specialities of the Madras Irrigation Works.

* Financial results of Irrigation Works in the North-western Provinces up to the close of 1872-73.

4. The Governor-General in Council is aware that the consolidated assessment of land-revenue that prevails in the greater portion of the Madras Presidency renders it difficult to make up an immediate account of the results of the smaller Irrigation Works. But for the larger works in the Godavery and Kistna Deltas, it is not understood that there is anything to prevent the submission of returns showing the financial results in those deltas. A portion of the revenue of these districts is already levied under the name of water-rate and is shown separately in the annual Land-revenue Report of the Madras Presidency. In cases where the water-rate is not distinguished in the assessment, the necessities of the case could be met by taking the difference between the dry and the wet rates as the revenue due to the works, the amount of any further indirect revenue being left to be ascertained by future inquiry.

5. It is understood that the area of land protected by each work, and in consequence of which the wet rates of assessment are charged, are on record in the District Offices, as also the amount of total wet revenue realized from each tract. If this be so, then there would not seem to be any real difficulty in ascertaining the direct return, and working up the amounts in a regular series of statements for present financial purposes. If in any case there was any wet revenue before the construction of the works, the proper course would probably be to deduct the difference between that revenue and the dry rates from the amount to which the work is entitled to credit.

6. It is, however, left to the Government of Madras to decide on the best way of arranging to meet the wishes of the Secretary of State for a correct account, and I am to inquire whether the Governor-General in Council may feel assured that the requirements of the Home Government will be met by the time indicated.

No. 279. ORDER THEREON, 17th June 1876, No. 1,502.

IRRIGATION, No. 19.
Account.

COMMUNICATED to the Board of Revenue in continuation of G.O., No. 1,500, dated 17th June 1876, with the volume showing financial results of Irrigation Works in the North-west Provinces up to the close of 1872-73.

2. The arrangements that have been made to ensure the preparation and completion of financial statements of Irrigation Works have been reported to the Government of India in the letter as per margin.

No. 1,501, dated 17th June 1876.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 280. Read the following Proceedings of the Government of India in the Public Works Department, (Account—Irrigation,) dated Fort William, 18th March 1876, Nos. 127—28 A.—I. :—

Preparation of Capital and Revenue Accounts for Irrigation Works in Madras and Bombay.

Read the following :—

Extract paragraphs 1 to 4 from Despatch from Secretary of State, No. 70 P—W., dated 18th November 1875.

I HAVE received your Excellency's letter, No. 63, of the 11th June last, forwarding the General Budget Estimate of Irrigation Works for 1875-76, together with a Note thereon by the Accountant-General, Public Works Department.

* * * * *

2. In the orders passed by your Government on the Budget Estimates of the several Local Governments, no credit is taken for any direct irrigation returns in either the Madras or Bombay Presidencies. The Bombay Government estimate the returns from Irrigation works in that Presidency at Rupees 35,49,247 ; but these figures have, I observe, not been adopted by your Government, as the returns are not considered to have been submitted in a sufficiently comprehensive form. In the Madras Budget the irrigation has not yet been separated from the land-revenue, and the returns given are only those expected to be realized from navigation and miscellaneous items of receipt.

3. The assimilation of the systems of account for Public Works in Madras and Bombay with that in force under the Government of India having now been determined on, it is hoped that no further delay will occur in the preparation of Capital and Revenue Accounts for Irrigation works in those Presidencies, similar to those now annually submitted from the Punjab and the North-west Provinces. Until this is done, it will be impossible that the Irrigation Budget Estimates can be submitted in a complete form, and I desire that the importance of expediting the preparation of those accounts may be impressed upon the Governments of Madras and Bombay.

* * * * *

ORDER.—Ordered that the extract read be communicated to the Governments of Madras and Bombay for information and guidance, in continuation of Public Works Department Resolution, Nos. 6—7 A.—I., dated 11th January 1876.

(Signed) C. H. DICKENS, Colonel, R.A.,
Secy. to the Govt. of India.

No. 281. ORDER THEREON, 17th June 1876, No. 1,503.

IRRIGATION, No. 20.

Account.

COMMUNICATED to the Revenue Department, the Chief Engineer for Irrigation, and the Examiner of Public Works Accounts, in continuation of G.O., No. 1,502, dated 17th June 1876.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following papers :—

No. 282. Endorsement of the Secretary to Government, Revenue Department, dated Fort St. George, 12th February 1876.

From C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, to the Hon. D. F. CARMICHAEL, Secretary to Government, Revenue Department, dated Madras, 31st January 1876, No. 283.

G.O., Public Works Department, dated 15th October 1875, No. 2,960, communicated in G.O., Revenue Department, dated 25th November 1875, No. 1,694.
G.O., Revenue Department, dated 22nd November 1875, No. 1,668.
G.O., Revenue Department, dated 1st December 1875, No. 1,727.
G.O., Public Works Department, dated 19th November 1875, No. 3,303.
G.O., Revenue Department, dated 30th November 1875, No. 2,518.

WITH reference to the Government Orders noted in the margin, I am directed to forward the accompanying memorandum, which contains the results of the Conference of the Members of the Board with the Chief Engineer for Irrigation and the Controller of Public Works Accounts on the subject of the preparation of Capital and Revenue Accounts of Irrigation Works, and of general reports on irrigation for each year. The memorandum has been agreed to by the Chief Engineer and the Board, but a dissent, of which copy is also forwarded, has been recorded by the Controller and Deputy Controller of Public Works Accounts.

2. I am to state that if Government approve of the conclusions arrived at, and the recommendations made in the memorandum, the Board will issue the necessary subsidiary instructions to Collectors.

MEMORANDUM.

THE subjects referred for consideration are—

(1.) The classification of irrigation works and the nature of the accounts and statements to be kept to show the financial results of expenditure thereon.

(2.) The instructions to be given to Mr. Wilson, who has been appointed to compile the information as to revenue receipts, which is required for the preparation of Capital and Revenue Accounts.

(3.) The nature of the annual reports on the results of irrigation which it is desirable and practicable to furnish.

(4.) The way in which Public Works Officers placed in charge of irrigation works shall be supplied with such information as to Revenue as is required by them for administrative purposes.

2. The first subject involves, besides classification of works, the determination of the method in which expenditure is to be exhibited, and of the principles on which the revenue due to irrigation and the profit or return from expenditure on particular works are to be arrived at.

3. *Classification of Works.*—As regards classification, it is considered by the Conference that, looking to the amount of labor involved in the preparation of technical Capital and Revenue Accounts in the manner required by the Government of India, the number of works to be so treated should be restricted, and that the following nine works only should be taken up :—

1. Godavery Delta Works.
2. Kistna Delta Works.
3. Pennair Anicut.
4. Chembrambaukum Tank.
5. Madras Water Works.
6. Palar Anicut.
7. Pelondorai Anicut.
8. Cauvery Delta Works.
9. Striviguntum Anicut.

These works should form Class I.

4. There are, however, many other works which are of considerable importance, and for which similar accounts but extending to less detail, according to the form in Appendix A, should be maintained. The following may by taken as examples :—

Districts.	*Works.*
North Arcot... ...	Cheyaur Anicut.
Do.	Poiney do.
South Arcot... ...	Vellaur (Shatiatope) Anicut.
Do.	Pooniar Anicut.
Coimbatore	Bhowany and Ambravati Channels.
Tinnevelly	Tambrapurni Anicuts above Striviguntum.
Nellore	Sungum Channels from the Pennair and connected works.

5. The Chief Engineer for Irrigation will obtain from the several District Engineers lists of all the important irrigation works in their districts on which considerable expenditure has of late years been incurred, or on which such outlay will probably be shortly made, in placing the works on a satisfactory footing; and, after considering the claims of the works in these lists to have their results separately ascertained and recorded, will furnish to the Revenue Board and Controller of Public Works Accounts and District Officers a complete list of such works, in order to arrangements being made for ascertaining as far as possible, on the one hand all past outlay upon them, and on the other the revenue obtained from them in past years; and also for maintaining a regular record of current expenditure and income.

The works which eventually find place in this list will constitute Class II.

6. After careful consideration of the classifications proposed in the Government Orders noted in the margin, the Conference is of opinion that, as it will be impracticable to determine the revenue derived from each class until the classification of every work of the 40,000 in round numbers which exist as Government sources of irrigation in the Presidency, has been determined, and as this classification is arbitrary and is of no practical value for administrative purposes, all works other than those falling under Classes I. and II. described above should be grouped by districts under a single class. There will then be three classes of irrigation works, *viz.* :—

30th April 1872, No 1,102, P. W. D.
3rd „ 1873, „ 1,030, „
15th October 1875, No. 2,960, „

I. The large works, nine in number, specified in paragraph 3, for which Capital and Revenue Accounts in full detail are to be kept.

II. The important works referred to in paragraph 4.

III. All other works.

7. *Exhibition of Expenditure.*—The outlay on works of Class I. will be recorded and exhibited as far as possible in the manner prescribed by the Government of India, but the Conference is of opinion there will be difficulty in carrying this classification out in detail. The classification of the integral portions of each irrigation work will be obtained from District Officers and communicated to the Controller by the Chief Engineer.

8. As regards other works, the Conference observes that the circumstances of the great majority of irrigation works in this Presidency are essentially different from those of the works of Northern India, and it is believed that, if a true idea is to be obtained of the results of their

management, it is requisite that expenditure on material improvements should be treated as a Capital charge, and should not be included either directly or indirectly in Revenue charges which represent the cost of maintenance to which expense of improvement does not appertain. All expenditure made as an investment whether for the purpose of increasing gross revenue or of reducing the cost of upkeep should with the limitations hereafter noted be treated as capital outlay. These opinions are in accordance with the Government Orders noted in the margin.

24th July 1874, No. 2,003, P. W. D.
15th Oct. " " 2,960, "

9. As to the manner in which charges to be considered capital and revenue outlay respectively are to be discriminated, it is observed that certain limits have been laid down for different classes of works below which limits expenditure on improvements should be treated as a revenue charge. It is not desired to alter that arrangement in principle, but the Conference would recommend that while the limit prescribed for works of Class I., *viz.*, Rupees 2,500, remains unchanged, that for works of Class II. should be fixed at Rupees 1,000. Works of Class III., however, are of such different size and importance that no such arbitrary criterion of amount can be prescribed, but taking into account that District Officers can sanction improvements under the name of Minor New Works to a limit of Rupees 750, it appears to be desirable to lay down the following rule for their guidance :—

G. O., dated 30th August 1875, No. 2,482, P. W. D.

When the improvements to an Irrigation Work, found to be necessary, do not exceed one-fifth of the average annual gross revenue derived from the work for the previous five years, the cost will be chargeable to revenue, otherwise to capital. It is to be understood that the amount of the estimate for all the required improvements together should not exceed one-fifth of the revenue in order to bring the charge under revenue, and that no second sanction for the same Irrigation Work can be given by District Officers within a period of five years.

10. Every estimate sanctioned by a District Officer should show distinctly the head of charge and also the average revenue to enable the Controller of Public Works Accounts to see that the former has been correctly indicated. The orders on estimates for works of Class III. sanctioned by Government can show as at present the intended head of charge, which should, it is considered, continue to be determined with reference not to the amount involved, but to the nature and object of the outlay and to the revenue of the work on which it is to be made.

11. The expenditure on all works of Class III. collectively in each district will be exhibited under Capital and Revenue in an abstract statement of the same form as Appendix A., but without any sub-division of charges under "Works."

12. In dealing with past expenditure, the accounts of which have not been kept in the detail and classification now considered necessary, the settlement of the head to which doubtful items should be debited should be left to the discretion of the Controller, who can obtain the orders of Government as to the treatment of amounts of importance requiring arbitrary disposal.

13. *Receipts from Irrigation. General Principles.*—In the Circular from the Government of India, communicated with G.O., Public Works Department, dated 19th November 1875, No. 3,303, as to the classification of receipts from Irrigation Works, a distinction is drawn between direct and indirect receipts from works for which Capital and Revenue Accounts are to be kept; the former comprising water-rates and some other items, and the latter (regarding the classification of which separate orders are promised) being explained to be "land revenue due or dependent on the works" (*sic*).

14. There can be no difficulty in this Presidency as to the exhibition of direct receipts under Items III. to X. of this classification, *i.e.*, of receipts other than those due to irrigation of land for purposes of cultivation. But from the order of the Government of India it is apparent that it is desired to enforce a division of receipts from irrigated land into two portions, due respectively to the land itself and to the use of water for its irrigation.

15. The Conference is decidedly of opinion that no such division can be made as regards this Presidency, however suitable it may be found for Northern India. On this question it

adopts the opinions which have been urged in the Proceedings of the Board of Revenue noted in the margin, and which are expressed in the Memorandum of the results of a Conference held in 1868, consisting of Colonels Strachey and Anderson and Mr. J. D. Sim. In that paper it is urged that in Madras the distinction could only be established in an arbitrary and imperfect manner; that no advantage would accrue from it; that if it were abandoned the figures for irrigation revenue can be taken without alteration from the existing revenue accounts; and that in practice a failure of the water-supply involves loss of the whole revenue and not only that part of it due to water.

17th June 1872, No. 1,018.
30th July 1873, " 1,439.
8th Aug. " " 1,527.
19th June 1875, " 1,698.
7th Sept. " " 2,502.
Board's Proceedings, 7th April 1868, No. 2,589.

16. The revenue from wet land in the Madras Presidency is based on a valuation of a share of a *wet* crop, and there are absolutely no data existing on which a portion of these wet assessments can be declared to represent a valuation of the land for dry cultivation. Even in the case of the Godavery and Kistna Deltas, where what are called non-consolidated wet rates exist, *i.e.*, where the assessment consists of two separate portions, the land assessment so called and the water-rate, the separation is illusory. In the Godavery and in the Eastern Delta of the Kistna the irrigable qualities of the land were taken into account in fixing the land assessment to which the uniform water-rate was to be added; and in the settlement of the Western Delta of the Kistna, a special standard grain was selected, the prices of which gave a commutation rate suitable for wet produce. Thus the wet assessments in these tracts, which are the only ones in which non-consolidated rates so called exist, are in reality consolidated wet rates, an arbitrary and uniform portion of which has been called water-rate. Further, a water-rate should represent either the price of the quantity of water requisite to bring the crop to maturity, or the value of irrigation to the land; and since these vary with soil and other circumstances, a uniform water-rate, such as exists where non-consolidated rates have been introduced in this Presidency, cannot fulfil this requisite. It would be therefore fallacious to take this so-called water-rate alone as the irrigation revenue. The separation proposed is entirely inconsistent with a system under which the Government demand on wet land is based upon a share of a wet crop.

17. The Conference therefore recommends that, in all accounts and statements which exhibit irrigation revenue, land assessments as well as all charges for irrigation which can be identified as chargeable on account of the particular land irrigated should be included. It is believed that all such payments, except Zemindari peishcush and quit-rents on whole Inam villages, can be so identified as chargeable on particular lands.

18. It falls to officers of the Revenue Department to furnish particulars of revenue from irrigated land. Other items of irrigation revenue are now credited in the financial accounts to the Public Works Department; and it will be for the Controller of Public Works Accounts to furnish, or obtain from the Accountant-General, details of such credits, and to classify them according to any system which may be prescribed by the Government of India.

19. The heads under which revenue from irrigated lands should be classed are those which have been adopted by the Board of Revenue for what are called "Channel Registers," of which a form has been prescribed in Board's Proceedings, dated 16th July 1873, No. 1,305. These statements should be furnished for all works embraced in Class I., and will eventually be required for all works which may be placed in Class II. With the modifications to be specified below they will furnish the data as regards receipts of each year required for drawing up the Capital and Revenue Accounts for works in Classes I. and II. They can also be made to furnish to the officers of the Public Works Department information which will be of value to them in regulating the irrigation under these works, and indicating in what direction measures are required for increasing or economizing the supply. With this object Column 1 should be abolished and the irrigation under each canal shown together in whatever taluq situated. It is understood that instructions will at once be issued by the Chief Engineer for Irrigation to District Engineers for the supply to revenue officers of a list of the canals or branches for which separate particulars of irrigation are to be furnished.

20. The form shows—

(1). *Columns* 3 *to* 22.—The extent of Government land charged as irrigated, and the charge thereon for first and second crops, the charge columns being sub-divided into assessment and water-tax. In order to carry out the orders conveyed in G.O., 18th June 1873, No. 1,592, Public Works Department, which have hitherto been misapprehended, instructions should be given that opposite each canal there should be two lines, the first showing the extent and assessment of lands charged with consolidated wet rates, and the second the extent and charge in the case of lands charged with non-consolidated rates and with dry assessments and water-rate. In the very few cases when a charge is made upon wet lands in addition to consolidated wet assessments, the whole charge should be shown in the first line in the column headed "Assessment." There will never be any entries in the column headed water-rate in the first line.

(2.) *Columns* 23 *to* 37.—The extent of, and quit-rent or jodi payable to Government on, Inams irrigated, and the water-rates charged on Inams and Zemindaris.

No portion of the peishcush on Zemindari land can be shown as already stated as revenue on irrigated land, as there are no means of identifying the charge. The same is the case as regards quit-rents on Inams made up of whole villages, unless they consist entirely of wet lands and have no waste. The entries in the quit-rent column will therefore embrace only quit-rents on minor Inams. These Inams consist sometimes of both wet and dry lands; but the assessments are known, and the portion of quit-rent entered in the column should in such cases bear the same proportion to the total quit-rent as the assessment of the wet lands comprised in the Inam bears to the total.

Inam lands irrigated and liable to charge fall under the following classes :—

A.—Bearing quit-rent but not liable to water-rate.
B.— Do. do. but liable to water-rate.
C.—Bearing no quit-rent but liable to water-rate.

The extent and quit-rent in the first case should be shown in the first line opposite each canal, and the extent and charges in the other two lumped together in the second line; as in this way the whole extent liable to water-rate will be shown together.

Together with these items should also be shown in the second line the extent of Zemindari land charged with water-rate, after deduction made for extent which is irrigated free as "Mamool wet." When any portion of this consists of charge arrived at by a composition of water-rate, details of the extent and charge in case of such lands included in the body of the statements should be given in the remark column.

(3.) *Columns* 38 *and* 39.—The extent of Inam and Zemindari land irrigated free of all charge. In these columns will be shown in one line the extent of Inams irrigated but not liable to either quit-rent or water-rate, and the extent of Zemindari land irrigated, but exempt from charge as "Mamool wet."

21. It will be seen from the above that the Conference proposes to include in the statement of irrigation revenue the dry assessments of lands under irrigation; but this assessment ought to be excluded from the profit due to irrigation works when the land was already occupied before the extension of irrigation to it, and to be included only when the land was taken up from waste and irrigated under the work. The extension of occupation and of revenue is affected by a multiplicity of causes, of which the construction of irrigation works is only one. It would be impossible to allow for indirect influences, which are doubtless themselves re-acted on, and intensified by, the existence of the works; but the distinction above stated is an obvious one, and also one of considerable importance and influence upon the results so far as they are capable of being computed in money.

22. To make the adjustment in practice however is not easy. The deduction on account of lands already occupied must be made by addition to the standard revenue, or assumed normal revenue from the lands irrigated, prior to the construction of the work. This standard must be obtained by averaging the revenue for a series of years; and strict accuracy would require that the history of each field, which is the unit of revenue charge, should be traced throughout.

This, however, would be an almost interminable labor, even if village accounts in which alone particulars of fields are entered, were available throughout. The Conference is of opinion that for obtaining the standard revenue the village should be considered as the unit, and the average deduced from the gross irrigation revenue of villages for a series of years. This will usually be ascertainable from the abstracts made for Jamabandi purposes and preserved in the taluq offices, and no reference to the detailed fieldwar accounts kept in the villages will be necessary.

23. For the deduction to be made on account of occupied dry lands, inquiry as to fields cannot be avoided without risk of error. The Board in their Proceedings, 30th July 1873, No. 1,349, have directed that the area and assessment of occupied dry lands brought under irrigation in each year should be shown in additional columns in the channel registers, with the intention that for Capital and Revenue Accounts the assessment so stated should be deducted from the gross irrigation revenue in each subsequent year. But such land might cease to be irrigated, and the continued deduction of its assessment would therefore be improper; while, if the land after ceasing to be irrigated was again supplied with water, the deduction would be made a second time. The columns added to the channel registers should therefore show—

(1.) Extent and assessment of occupied dry lands brought under irrigation in the year.

(2.) Extent and assessment of such lands remaining under irrigation out of those shown in the previous column in former returns.

(3.) Total.

The assessment in the last column would be the amount to be added to the standard revenue for deduction from the gross irrigation revenue to get the profit of the year. Endeavor should be made to provide for the record of these particulars in the village account forms now under revision.

24. This point will be the only one on which the village accounts for past years will have to be consulted in preparing the accounts of past profit. When village accounts have been destroyed or are not forthcoming the following method will, it is believed, be found practicable, and will yield the best results attainable in such case. The assessment on lands charged with tirvajasti (additional charge for water) in the year in which tirgation was extended to the village, and in each subsequent year, will be ascertainable from the taluq abstracts. It will be on the safe side to assume that any increase in this assessment which may be found from year to year will belong to occupied land, and accordingly the amount of this increase, if there is any, should be deducted in addition to the standard from the gross wet revenue in each year. (The assessment of dry lands irrigated will, of course, be included in the statement of gross irrigation revenue.) From the earliest year for which village accounts are forthcoming the particulars of assessments on fields for the columns to be added to the channel registers as stated above should be ascertained and the amount deducted in addition to the standard, and to the amount of deduction last made for increase of land paying tirvajasti.

The following examples will make the matter clear. Suppose a series of figures to be obtained as follows:—

Fasli.	Assessment of Dry Lands charged for Water.	Assessment of Dry Lands irrigated known to be already occupied. (Columns to be added as above stated to Channel Registers.)	Deduction to be made in addition to Standard Revenue.
	RS.	RS.	RS.
1250	150	...	...
1251*	160	...	10
1252	155	...	5
1253	170	...	20
1254†	175	10	30
1255	190	15	35
1256	185	15	35

* Year of extension of irrigation to the village.

† First year for which village accounts are available.

Here the Rupees 150 shown in Fasli 1250 is supposed to be included in the standard revenue being part of the gross irrigation revenue for previous years on which the average is struck. In Fasli 1251 an increase of Rupees 10 is found; and, as in the absence of village accounts it is not known whether the land was occupied or not before it was irrigated, it is assumed for safety's sake to have been so, and the amount deducted in addition to the standard revenue. So also in Faslis 1252 and 1253, Rupees 5 and Rupees 20 are similarly deducted. For Fasli 1254 and afterwards village accounts are available, and show occupied dry lands, assessed at Rupees 10, to have been newly irrigated. This amount is therefore added to the assessment on lands assumed to be similar and to have been brought under irrigation since the construction of the work and up to the previous year, *viz.*, Rupees 20; and the sum Rupees 25 deducted in addition to the standard revenue, and so also for subsequent years. The whole amount of the assessment on dry lands irrigated is of course to be included throughout in the statements of irrigation revenue.

In the Godavery and Kistna Districts, where non-consolidated assessments exist, the plan of deducting the increase year by year in the assessment of dry lands charged for water would not answer at the present time, since full liberty is now conceded to ryots of taking or relinquishing water as they please. It will answer however for the period prior to the introduction of this rule, for lands were then registered separately as wet and dry. For subsequent years village accounts are available. In these districts it is necessary to observe that considerable changes of registry of lands from dry to wet have been made under the rule that land irrigated for three years should be classed as wet, and also at the time of the Survey and Settlement. The principle on which these transfers should be dealt with is that dry assessment which had been deducted before should continue to be deducted afterwards.

25. The period of years to be taken for deducing the average or standard revenue has to be considered. The Government have suggested fifteen years, but there may be difficulty in procuring information for so long a period in the case of some works. It is also questionable whether so long a period ought to be taken. All that is wanted is a sufficient number of years to get rid of the effect of fluctuations of seasons; and if too many are taken, the effect of the normal increase due to indirect causes, or causes independent of the improvement made to the works, come into play. These however work upon dry land rather than wet, and as the wet revenue of each village is alone to be taken into account, perhaps the best rule to lay down is that this should be ascertained for as many years as possible, not less than five or more than fifteen years prior to the improvement in the irrigation, and that the Board of Revenue should decide in each case on the information available what period should be taken.

26. The standard revenue so obtained however will change from year to year in the case of large works, such as the Kistna and Godavery Deltas Schemes, as irrigation is extended to villages not previously within the influence of the works. As soon as irrigation is so extended, the standard revenue of the village (that being the unit) must be ascertained and added to that ascertained for tracts previously included. Unless the channel register, which gives the irrigation revenue, includes the whole irrigation revenue for all the villages, the deduction of standard revenue will be too great. The Conference must therefore recommend that the channel registers shall show the whole irrigation revenue of the villages to which irrigation from the work has been in any degree extended. The irrigation revenue from other sources will generally be small, and its inclusion will not impair the utility of the statements as indicating the efficiency or otherwise of the arrangements for supply from the great works.

27. There are other circumstances, chiefly administrative changes, the effect of which has to be eliminated in calculating profit due to irrigation works. These may be classed as follows:—

(1.) Changes which amount to a transfer of irrigated land from a category in which it is chargeable to one in which it is not. Examples are, the assignments of land revenue made to pagodas, &c., in commutation of cash allowances, beriz deductions made on account of village service, and the like. When these changes have taken place subsequent to the construction of the works they must be allowed for by deducting the amounts from the standard revenue in all

subsequent years. In this way they will still appear as part of the profit from which, in fact, they are assignments.

(2.) Enhancement of quit-rents on Inams in consideration of enfranchisement. There is room for difference of opinion as to whether the increased payments obtained in such cases in commutation of the Government right to reversion should be credited to the profits or not. On the one hand, it may be asserted that the matter has no connection with irrigation, and, on the other, that the Inamdars were induced to accept the increased liability, and were enabled to make the increased payments by the presence of improved irrigation. On the whole, the Conference is of opinion that the additional quit-rents should be included in the profit. The item will not be a very large one. The old quit-rents will of course appear both in the standard revenue and in the subsequent gross receipts.

(3.) Direct changes in the demand on lands, such as reductions of assessment on land watered by falling rains only, or by private wells; alteration of system, such as the abolition of ulungu, or general revision of rates on the introduction of the new settlement.

Direct reductions of assessment made on grounds of general expediency such as those above named ought not to go to diminish the profit from the projects, and therefore the allowance for them should be made in the shape of permanent deduction from the standard revenue.

The abolition of ulungu will probably have to be considered only in the Cauvery Delta, and had best be treated in the same way as will now be proposed for general revisions of rates under the new settlements.

These revisions of rates generally result in an increase on the whole in revenue from irrigated land. The increased assessments on tracts affected by large irrigation works have doubtless been to a great extent rendered possible by the improved irrigation, and might in many cases be properly credited in full to the projects. But it would be impossible to prescribe a criterion by which the facts for each village or tract could be worked out in detail, and some rough method must be devised for making the necessary allowance; that is to say, for crediting to the project such portion of the increased revenue as is properly due to it, and subtracting from the profit such portion as has been rendered possible by general causes. The best method seems to be to take the wet (Government) lands in occupation at the date of the introduction of the new rates in villages affected by the new irrigation, and in those not so affected, and to ascertain the ratios of increase by settlement in these tracts respectively. Any excess found in the increase in the tracts under the influence of the works above what would result from the application of the ratio of increase ascertained for the rest of the district is properly to be credited to the project. The method of making the allowance for the effect of settlement will therefore be to deduct from the gross revenue of each year subsequent to settlement, not only the standard revenue, but also such sum as will represent an increase, for the settlement year and for the villages then under the new irrigation, in the same proportion as found to result from settlement in the rest of the district.

It is to be understood that as the effect of the new irrigation was considered in fixing the new rates in all villages which were eventually to be brought under it, all such villages should be included with those actually benefited at the particular date, in deducing the ratios of increase just referred to. It may be that in some villages the introduction of the new settlement rates may have taken place in the period taken for deducing the standard revenue, *i.e.*, prior to the extension of irrigation to the villages. In such cases, which will probably be rare, the revenue for the years in which the new settlement rates have been in force should first be corrected by deducting such a percentage of increase as is found to be due to the work, *i.e.*, the excess of increase in the specially irrigated wet lands over that in the rest of the wet lands of the district, and striking the average revenue on the amounts left after such correction.

28. The following examples will show what is meant:—

(1.) The standard revenue for a village is Rupees 1,000. The revenue on the irrigated lands for the year of settlement is Rupees 1,200 at the old rates, and Rupees 1,500 at the new. The revenue of all wet lands in the district other than under the project is found to be increased

by settlement from 5 to 5½ lakhs or 10 per cent.; while that of the wet lands irrigated under the project is raised by settlement from Rupees 10,00,000 to Rupees 12,20,000 or 22 per cent. Of the actual increase, therefore, 10 per cent. is due to general causes, and the rest to the special irrigation. Rupees 120 are therefore to be added to the standard revenue of the village in question, and the amount for the settlement year and subsequently will be Rupees 1,120.

(2.) The wet revenue of a village to which irrigation has just been extended is as follows :—

Fasli.	RS.	Corrected Revenue.
1250	500	500
1251	540	540
1252	510	510
1253*	600	541
1254	620	559
1255	590	532
		3,182
Average or standard revenue ..		530

* Settlement year.

Here as 12 out of a total increase of 22 per cent. on the old rates was due to the benefit anticipated from the project, 9·84 per cent. of the settlement revenue is deducted before the average is struck. Strictly speaking the excess revenue realized in anticipation of the extension of irrigation ought to be credited to the project, but this is scarcely feasible; and the whole increase ought not in strictness to have been demanded before irrigation was afforded.

$\frac{12}{122} = \cdot0984$.

29. The principles and examples above stated assume an increase by settlement, and a special increase by specially good irrigation. But it may of course happen that the case is not so; and if so, a deduction from, instead of an addition to, the standard revenue will have to be made.

The principles enunciated in the foregoing paragraphs will determine the net receipts from irrigated land which are to be entered in the Capital and Revenue Accounts which are to be opened at once for all works in Class I., and eventually for all works in Class II. also.

30. It is here to be noted that all the information as to revenue from irrigated land which can be given must refer to demand only and not to collections, as no separate accounts are kept of collections from irrigated and unirrigated lands. No such separation would be possible without a complete revolution in the revenue system, and this fact renders impossible in Madras any separate exhibition of irrigation revenue in the Civil Finance Accounts. The collections of course cannot exceed the demand; and as arrears of the demand as settled, *i.e.*, exclusive of remissions, rarely accrue on wet land, the revenue actually collected will not fall much short of that shown in the statements. Information as to the demand will be practically sufficient for the present purpose. It must always be given for the fasli year.

31. (ii). *Instructions for Mr. Wilson.*—The Chief Engineer for Irrigation having stated that it is of great importance that the Capital and Revenue Accounts of the Kistna Delta works should be completed without delay, and information collected as to the probable results of further extensions in view to the disposal of estimates now in hand, it is resolved to direct Mr. Wilson to proceed in the first instance to the Kistna District. It will also be of advantage that he should commence the work in a district with which he is thoroughly familiar. He should proceed to frame statements in the form above referred to and on the principles above stated for as many years as may be necessary, and should arrange the information according to a list of canals which he

should obtain from the local officers of the Public Works Department, to be submitted, if he thinks this desirable, for the approval of the Chief Engineer for Irrigation. Mr. Wilson should prepare the statements as completely as possible for all past years as far back as may be necessary; but if accounts whence full details can be obtained are not forthcoming, he must make the best approximation to the totals of irrigated revenue that may be feasible from the district records. As the inquiry as regards past years is only to ascertain profit, information as to areas need not be given for the earlier years unless it is readily forthcoming, but it should, if possible, be made complete for Fasli 1285 (1875-76) and subsequent years. The standard revenue to be applied for each year should be stated and explained, and the profit to be credited in each year worked out. In case of any difficulty of detail, he should apply to the Board of Revenue for instructions; and should lose no time in proposing such establishments as he may require for the work. The Collector should be instructed to give him every assistance in his power.

32. Mr. Wilson's inquiries should extend not only to the area now irrigated, but also to that which will ultimately be brought under the influence of the works; and he should endeavor to collect data for an opinion as to the probable result of further extensions contemplated but yet unsanctioned. On this subject he should address the District and Chief Engineers, who will afford him full information as to the tracts which will be benefited and the mode of supply.

33. (iii.) *The nature of the Annual Report on Irrigation results which it is desirable and practicable to furnish and* (iv.) *the way in which Public Works Officers are to be supplied with information as to Revenue results.*—The Conference next proceeds to discuss the third and fourth subjects mentioned in paragraph 1 of this Memorandum which are very closely connected. The only statement now furnished, except the Board's settlement reports, which at all bears the character of a general statement of irrigation results, is that furnished under G.O., dated 25th July 1872, No. 1,766. This statement shows the entire revenue charged in each district on lands as irrigated; and the figures for receipts therein given, contrasted with the charges for improvements and upkeep of the works reported by the Controller, Public Works Accounts, are submitted to Government with a Note by the Chief Engineer for Irrigation. The objects of the report desired are to be gathered from the Note by the Chief Engineer, printed in G.O., Public Works Department, dated 22nd November 1875, No. 1,668. They seem to be that it may be possible for Government to take a general view of the management of irrigation works, the revenue derived from them, and the charges; that such general information as to remissions of demand may be given as will indicate to what extent they are due to preventable causes, in what quarter special remedial measures are necessary, or on what points special explanation should be called for.

34. These being the objects in view, the Conference is of opinion that the statement of receipts should not embrace as hitherto the revenue from wet lands in Malabar and other districts in which there are no irrigation works, or in which no expenditure is incurred upon such works by Government, and also that the revenue from lands classed as wet, as growing wet crops, though with the assistance only of falling rain, should be excluded. There are certain other items which in strictness ought also to be excluded, such as wet revenue from lands irrigated from wells and springs which are not repaired by Government, lands under tanks in rented villages, and under Dasabandam tanks; but the Conference is of opinion that it is not worthwhile attempting to separate these items, and that, so far as they are concerned, the statement should be prepared as hitherto.

35. The general review which embraces expenditure as well as receipts, and is principally directed to the effectiveness of such expenditure, should be drawn up by the Chief Engineer for Irrigation. The information as to outlay to be furnished by the Controller, and that as to the receipts to be furnished by Collectors, through the Board of Revenue, should be arranged according to works of Classes I., II., and III. as above detailed; and, with the details contained in the special reports referred to below, will constitute the materials for the general report to be drawn up by the Chief Engineer.

36. A single form for statements of irrigation revenue to be furnished by Collectors can be made to answer all purposes, for Capital and Revenue Accounts, for works both of Classes I. and II., and for the general irrigation review. The form already in use for the channel registers will answer, columns being added to show remissions, which should be classed thus—

(1.) Fixed remissions.

(2.) Occasional remissions.

(*a.*) Due to preventable causes, such as inefficient works of supply or drainage.

(i.) Excess of water.

(ii.) Defect of water.

(*b.*) Due to bad season and casual failure of supply.

(*c.*) Other occasional remissions. The net revenue and remissions for works in Class I. should be given in full detail of canals as prescribed, and each work in Class II. should have separate details, while all those of Class III. should be grouped together.

37. Instructions should be issued by the Board of Revenue to Collectors to submit with their Jamabandi reports statements prepared accordingly and accompanied by a Note containing such remarks on the several points connected with the irrigation of the district and the results of the year as will be found more particularly prescribed below. A separate statement, with details for canals, &c., should be furnished for each work in Classes I. and II., and a general abstract statement should also be sent to show the whole results for the district, the totals for the works of Classes I. and II. being entered in order, and all works of Class III. being grouped together in a single line. These statements would be examined and checked with the other settlement returns in the office of the Board of Revenue, and transmitted to the Chief Engineer. Copy of the statements and of the note should be sent by the Collector to the District Engineer, so that that officer may have an opportunity of submitting to the Chief Engineer without delay his remarks on the causes of inefficient supply or drainage.

38. These statements will be progressive as regards amount of detail as particulars for works in Classes I. and II. become available. No revision of the statements will be necessary hereafter for purposes of comparison, because whatever comparison is necessary in respect of works of Classes I. and II. will be based not upon the particulars given in the annual statements, but upon those posted from them into the special accounts to be maintained for each work in the Controller's Office.

39. In these statements sufficient information as to the effect of the condition of the works on the revenue will be furnished to the District Engineers as regards works in Classes I. and II. It remains to make provision for information being furnished to them as regards particular works which in the general statements will be grouped together in Class III. It appears to the Conference that this had best be done in connection with the tank registers compiled under the orders noted in the margin. The form in which the information is now furnished does not contain particulars of remissions, but columns can easily be added to give them under the classification suggested above.

Board's Standing Order, No. III. of 1869, (67-2).
Board's Proceedings, dated 8th August 1873, No. 1,527.

40. These tank registers are records of great importance, and if the entries in them could be fully relied on as correctly prepared, which the Conference is disposed to doubt, their existence would hereafter much facilitate the inquiries which will have to be made whenever it is proposed to transfer a work from Class III. to Class II., and to open accordingly an account for it extending back over many previous years.

41. The Conference is of opinion that revised forms and instructions should be issued by the Board of Revenue as to the mode in which the information as to revenue results should be supplied to District Engineers, and that the importance of the information being sent to them

as soon as the Jamabandi of each village or taluq is completed, so that early steps may be taken to remedy defective condition of works, should be especially impressed upon Collectors.

42. The note or irrigation report which should accompany the statements of irrigation revenue to be submitted by Collectors to the Board as above detailed should be made as comprehensive as possible. It is impossible to put on paper definite instructions as to the numerous matters connected with irrigation which should be noticed in such reports. Much must depend upon the local knowledge and interest of the writer, who must have an intimate acquaintance with the works, with the revenue system, with the influence of trade, and other subjects bearing upon the agricultural interests of the districts or tracts concerned. The officers of the Public Works Department will be the chief authorities on some branches of the question, and in compiling their reports Collectors should be instructed to confer freely with the District Engineers. The note should first state the return of the year on works for which Capital and Revenue Accounts are kept, *i.e.*, for works in Class I. and in Class II. as soon as these are taken up. The modification in the standard revenue which may be necessary should first be noticed for each work; to it should be added the assessment on already occupied dry lands brought under irrigation, and the total deducted from the whole irrigation revenue to get the return for the year. The note should then proceed to give information on points of interest connected with the works as follows:—

The important works which constitute Class I. should be dealt with individually and at some length. The Conference note a few of the points which suggest themselves as likely to require notice. The irrigation may have developed faster or more slowly than was to be anticipated; water may have been much in demand or the reverse, either generally or in the case of particular canals or works; the freshes and rains may have been seasonable or otherwise, and may have produced corresponding results; projects may have been pushed forward in the right direction, or it may be found to be advisable to alter the programme of future working; the popularity or otherwise of the works, and their value as affecting the prosperity of the district generally, may require notice; the supply may have outrun the means of distribution, or the reverse; ryots may have shown indisposition to use the water available, or may have attempted to irrigate beyond the supply which is forthcoming; the soil of some tracts may have proved unsuitable, and dry crops may have been found more profitable; abnormal demands for special products or the state of communication with markets may have exercised influence; and there are doubtless many other points on which the special circumstances of each work or locality may suggest remarks to District Officers.

The reports on works of Class II. will be more brief. These works generally affect smaller areas; the results will be more easily and speedily arrived at, and improvements, if needed, can be more readily understood and determined on.

Works of Class III. will necessarily be dealt with collectively, but anything noticeable in connection with particular works should be specially mentioned. The season will always exercise more or less influence on the results of works of this class, and as season varies in character, frequently in different parts of the same district, its effects can be contrasted. The direction in which more liberal expenditure would be beneficial would be an important point in many districts, and any changes in administrative or executive arrangements which may suggest themselves should be noticed.

43. The Conference is of opinion that the statements and reports now recommended should supersede all statements and returns as to irrigation revenue which Collectors are now required to furnish to the Public Works Department. The forms which will be prescribed under this Memorandum will ensure that information as to irrigation revenue will be compiled on uniform principles, and the misunderstandings and apparent discrepancies which have so often arisen in the past will, it is hoped, be avoided in future.

(Signed) C. A. GALTON,

Acting Secretary.

APPENDIX A.

Capital and Revenue Account of

to end of the year 1878-79.

—	Capital			Revenue		
	To end of 1877-78.	1878-79.	Total.	To end of 1877-78.	1878-79.	Total.
Preliminary Investigation.						
Land						
Works—						
Head works						
Supply Channels ...						
Reservoirs						
Distributaries ...						
Buildings						
Miscellaneous ...						
....						
Establishment						
Tools and Plant						
Suspense Accounts ...						
Abatement of Land Revenue lost						
Interest						
Total ...						
Less Receipts						
Net ...						

Dissent by Controller of Public Works Accounts and the Deputy Controller for Irrigation.

BELIEVING that the object which Government had in view informing this Committee was to obtain a final settlement of every question connected with the preparation of the Capital and Revenue Accounts of the Irrigation works in the Madras Presidency, we find ourselves as regards principles unable to assent to certain of the conclusions arrived at by the majority of the Committee, and, as regards details for future procedure, we consider the recommendations made to be insufficient.

2. The Government of India according to their latest instructions do not desire that Capital and Revenue Accounts should be maintained for *all* the Irrigation works in this Presidency, but in cases in which some definite expenditure can be pointed to as Capital outlay and some definite receipts as Revenue resulting therefrom, the sufficiency of the relation of the Revenue to the Capital being in each case ascertained and recognized, the Government of India desire that Capital and Revenue Accounts shall be kept in certain definite forms.

3. On the other hand, in cases where,

(*a*),—the Capital outlay cannot be ascertained;

(*b*),—there is no Revenue or expectation of Revenue; or,

(*c*),—where, although there exists both Capital outlay and Revenue receipts, the Revenue receipts cannot justly be ascribed to the Capital outlay;

the Government of India desire that the works be remitted to the class "*Ordinary Agricultural*" for which no Capital or Revenue Accounts are to be kept.

4. This principle clearly limits the number of works for which Capital and Revenue Accounts are to be maintained. In the face of this the majority of the Committee recommend that Capital and Revenue Accounts in some form or other be kept for *all* Irrigation works. From this recommendation we entirely dissent, as involving what appears to us to be an absolutely unnecessary and useless expenditure of public money.

5. To practically carry out this task of preparing Capital and Revenue Accounts of all the Irrigation works in the Presidency (said to amount to about 40,000 in number) the Majority of the Committee recommend,

(*a*),—that for certain specified works included in their Class I. separate Capital and Revenue Accounts be kept in the full detail prescribed by the Government of India;

(*b*),—that for certain other important works at present undetermined, which are to constitute their Class II., separate Capital and Revenue Accounts should also be kept but in less detail; and,

(*c*),—that for all other Irrigation works, combined or lumped, Capital and Revenue Accounts be kept by districts.

6. Our objections to these recommendations we will place on record in order.

Class I.—With regard to the works enumerated in paragraph 3 as constituting Class I., we should have preferred that the principle which guided the Committee in selecting these particular nine works should have been clearly stated. There would then have been some ground for forming an opinion as to the completeness of the list as it now stands, and as the investigation proceeds, for judging the claims of other works to be included in this class. In the absence of any enunciation of the principle which guided the majority of the Committee in selecting the works in Class I., we will simply confine ourselves to stating that at present we do not clearly see the distinction between Class I. and Class II. works.

7. The expenditure on the first class of works is to be exhibited *as far as possible* in the manner prescribed by the Government of India. We concur with the majority of the Committee in the opinion that, in the case of the Madras Irrigation works, there will be some difficulty in conforming to this classification in detail; we think it would have been better to have gone thoroughly into this classification and to have proposed such modifications as, without preventing a comparison between the Irrigation works in Madras and those in other parts of India in all cases in which the works really are comparable, would have made the classification of expenditure more suitable for the Irrigation works in this Presidency. We take for granted that neither the Government of India nor any body else wishes to institute an elaborate and detailed comparison between the Madras Water Works and the Ganges Canal system.

8. The present classification was, we believe, framed for systems of works consisting of a long main canal with a large net work of branches and distributaries—systems in which tanks and reservoirs are quite exceptional and altogether subsidiary. To a system such as the Madras Water Works consisting of a weir, a few miles of supply channel, and one or two large reservoirs—the reservoirs being the *main* features of the scheme—this classification cannot be applied without involving such an absurdity as calling the short supply channel a *main canal* and bringing in as entirely subsidiary to it a couple of reservoirs of which the bunds are nearly as long as the channel itself.

9. The Madras Water Works is merely a type of a large class of works common in the southern part of India, and it would, we think, have been better had the Committee stated that the prescribed classification is suitable only for one or two of the systems which they propose to include in Class I., and had they suggested for other system some more suitable classification. It is perhaps unnecessary to observe that the keeping of *technical* Capital and Revenue Accounts does not involve adherence to any particular system of classifying the expenditure.

10. *Class II.*—We object here to the want of precision in indicating the works to be included in Class II. From first to last the principal, if not the only practical, difficulty that has been experienced by the Accounts Department in dealing with the whole subject of the Capital and Revenue Accounts of Irrigation works has been that the determination of the works for which Capital and Revenue Accounts are to be kept has been left with the Chief Engineer for Irrigation, and that no one has been able to obtain from that officer a list of the systems for which Capital and Revenue Accounts are to be kept, together with the necessary information regarding the component parts.

11. It is obvious that the current expenditure on works can be properly recorded only after determination of the works for which Capital and Revenue Accounts are to be kept, and of the amount of detail in which these accounts are to be kept as regards the component parts of each system. As yet there has been no systematic and organized attempt to record current expenditure according to systems and component parts of the simple reason that, although instructions have been given to keep separate accounts for certain systems, no information has as yet been afforded as to what works or groups of works are comprised in those systems.

12. Every day further expenditure is being incurred which, were these points settled, might at once be properly booked, but which, under present circumstances, only adds more to that ever-increasing mass of arrears and confusion which Government sooner or later will have to pay an extra establishment to grapple with and bring into some sort of order. For ourselves we are wholly unable to account for the delay of months and even years that has occurred in getting out a list of the important Irrigation works in this Presidency. The printed Annual Appropriation and Outlay Statements, together with the maps, plans, and records which exist in the Chief Engineer's office, should, we imagine, be sufficient for the preparation of such a list practically complete within a week at the outside; but whatever the difficulty, whatever the delay, we do not think that the Committee should have separated without obtaining a definite decision on such an obvious preliminary.

13. *Class III.*—To the combined Capital and Revenue Accounts proposed to be kept for the works under Class III. we object on the ground that neither is it possible nor is it proposed to ascertain and recognize any definite expenditure as Capital outlay, nor is it proposed to make any attempt to ascertain and recognize any Revenue as resulting from Capital. It is proposed, in fact, to start so-called Capital and Revenue Accounts in which neither of the terms *Capital* and *Revenue* has any meaning whatever.

14. We fail to see that the majority of the Committee realize that these Capital and Revenue Accounts are required to serve a useful purpose, *i.e.*, to record the direct return which Government derives from money invested in Irrigation works, and that the means by which this object is to be attained is a comparison of some definite Revenue with the invested Capital to which it can be justly ascribed. For Class III., works taken in the aggregate, the Committee propose to record as Capital all future expenditure on new works and all future improvements of old works if in excess of a certain (or rather an uncertain) amount, and the only thing they propose to record as Revenue is the gross Revenue under all works, new and old. We are unable to see what possible connection there can be between this Revenue and the so-called Capital; and even could we see any connection between the two, the usefulness of the accounts would, in our opinion, be entirely destroyed by the whole of the works being lumped together.

15. That the majority of the Committee practically admit the uselessness of these lumped accounts is, in our opinion, shown by their recommendation to retain the old form of Tank

Registers. *Virtually therefore there is to be a separate account for every Irrigation work in the Presidency.*

16. With regard to the Tank Registers we will only remark that if an account of this sort is absolutely necessary for the purpose of ascertaining what tanks are to be maintained and what abandoned, we are of opinion that the record should be kept with some guarantee for its accuracy, and that this can only be done by making some central authority responsible for seeing that these books are properly kept up, and for devising the proper machinery for doing so. To make the District Engineers responsible for keeping up these books from accounts received from the Divisional Offices appears to us to be a departure from the accepted principle that District Engineers are not to be concerned in the compilation of accounts.

17. With regard to the incidence of charges as between Capital and Revenue, though we do not understand what are the *differences* alluded to by the majority of the Conference in paragraph 8 of their report, we cordially concur in the view which they have expressed on this point of principle—a view which apparently they base upon these differences; and we confess to feeling no little surprise when we find that in the very next paragraph of their report they recommend that, in the case of the great majority of Irrigation works in this Presidency, extensions and improvements costing less than *one-fifth* of the revenue dependent on them shall be charged to the Revenue Account. In *Northern India* they draw the line at something more like *one-fiftieth* or *one-hundredth.*

18. The principle on which *all* Capital and Revenue Accounts are based—the only principle indeed which can give to such accounts any meaning and usefulness—is that the cost of all original construction and equipment shall be charged to Capital, and the cost of maintaining the efficiency of such construction and equipment shall be charged to Revenue.

19. In order, however, to avoid incessant interference with the Capital Account it is in many cases found convenient to charge to Revenue all isolated additions and improvements, the cost of which is insignificant in comparison with the annual revenue; and on this ground it might perhaps be well that for the works included in Classes I. and II. of the classification adopted by the Committee (if that classification is to be adhered to) the proposed limits should be adopted for charges to the Capital Account, though this point should not be passed over without noticing that the revenue dependent on many of the works in Class II. will be found to be as large as, or larger than, that dependent on several of the works in Class I. In the case of Class III. there is no excuse for such a departure from principle, seeing that with these lumped accounts (if they are to be kept) incessant interference with the Capital Account must in any case take place.

20. Further, we think it well to point out that no convenience, but on the contrary considerable inconvenience, will be caused unless the limit below which original works are to be debitable to Revenue is made conterminous with the limit for Minor New Works.

21. In conclusion we beg to recommend—

(1.) That, as regards the keeping of Capital and Revenue Accounts, the wishes of the Government of India be strictly followed, and that such accounts be attempted only where some definite expenditure can be ascertained and recognized as Capital outlay, and receipts can be ascertained and recognized as resulting therefrom; and that expenditure on all other works be charged to the head Ordinary Agricultural.

(2.) That the limit, if any, below which extensions and improvements are chargeable to Revenue be Rupees 2,500, or as an alternative if this limit be considered too high for the works included in Class II., that the limit be Rupees 2,500 for Class I., and that for Class II. all Original Works be charged to Capital and only Repairs and Maintenance to Revenue.

(3.) We are further of opinion that the Conference should report fully on the books and returns which in connection with these accounts will have to be maintained both in the Revenue and in the Public Works Departments.

24*th January* 1876. (Signed) L. CONWAY-GORDON, Captain, R.E.,
Controller of Public Works Accounts.

(„) C. H. P. CHRISTIE, Lieutenant, R.E.,
Deputy Controller, Irrigation Branch.

TRANSFERRED to the Public Works Department.

(Signed) D. F. CARMICHAEL,
Secretary to Government, R. D.

No. 282-A. From W. WILSON, Esq., on Special Duty, Irrigation Accounts, to the Hon. D. F. CARMICHAEL, Secretary to Government, Revenue Department, dated Masulipatam, 31st March 1876, No. 3.

CONSIDERATION of the nature of the materials on which are based the statements of the financial results of anicut irrigation in the Kistna Deltas forwarded with my letter, No. 2, dated 28th March 1876, makes it necessary for me to submit, for the very serious consideration of Government, whether, whatever may be the case with regard to the Capital Accounts, it is in any way necessary or desirable further to employ a Special Officer for the preparation of the Revenue Accounts of irrigation in the Kistna Delta, or for any of the other works mentioned in the memorandum attached to Board's Proceedings, No. 283, dated 31st January 1876.

2. I am of opinion that it is not, because in the first place so far as the Eastern Delta of the Kistna is concerned, no amount of further inquiry will lead to any result more satisfactory than we have at present, and in the next an inquiry directed to the ascertainment of the exact amount properly to be credited to the anicut in the Western Delta would require a very much longer time than Government probably contemplated when appointing me to this special duty.

3. In the Eastern Delta there prevailed up to the year 1866-67, when a revised settlement, one of the features of which was the distinction between and separate record of land assessment and water-rate was introduced, the joint rent system under which the total demand fixed by Government on the village was distributed and apportioned by the ryots among themselves. There was under this system, speaking from a Madras point of view, no land assessment properly so called, that is, an assessment fixed by Government on each field or holding. Any attempt therefore to distinguish between land assessment and water-rate in this delta would be futile, while the task, if attempted, would be hopeless. Thus, in Gudivada, the portion of this delta chiefly affected by the anicut "usual wet" increased from Acres 35,898, assessed at Rupees 32,759 in 1854-55, the year before anicut irrigation began, to Acres 48,857, assessed at Rupees 1,25,465 in 1865-66, the year prior to the introduction of the new settlement, and the break-up of the joint rent system. In the year last named the "dry converted into wet" amounted to Acres 16,038, assessed at Rupees 68,279. From these figures it appears that in the year prior to anicut irrigation the average assessment of wet land in this taluq was Rupees 2-3-0 an acre, and in the last year of the joint rent system was Rupees 2-6-0 an acre, while that of "dry converted into wet" was in that year Rupees 4-2-0 an acre, and the average of "usual wet" and of "dry into wet" combined was just under Rupees 3 an acre. At that time the charge for water alone prescribed by Government was Rupees 4 an acre. So far as "usual wet" is concerned, therefore it is obvious that whether the water-rate of Rupees 3 which was in force between 1860-61 and 1863-64, or the present rate of Rupees 4 be taken as the basis of calculation for the determination of the amount due to anicut irrigation, any arbitrary division between land assessment and water-rate is impossible, for the average wet assessment is in either case less than the water-rate alone. If for "dry into wet" any arbitrary distinction were attempted by assigning the portion Rupees 4,

that is, the full water-rate, of the average assessment Rupees 4-2-0 to the anicut, there would remain an average of Rupees 0-2-0 per acre to be assigned to "land assessment," an amount so small that its inclusion in the return from the anicut would have but little material effect on the general result. The fact is, however, that the assessment of "dry into wet" was quite as consolidated as that of "usual wet," while it is extremely doubtful whether any means whatever exist of determining what prior to conversion was the dry assessment of the lands so as to assign accurately the portion of the assessment which whether equal to, or less or greater than, the Government charge for water should be assigned to the anicut.

4. In the Western Delta, where up till the year 1872-73 a ryotwari system prevailed, there existed, except in one division of one of the two taluqs* of which it is composed, a system of consolidated assessments. Dry lands converted into wet were under this system not simply charged with water-rate in addition to their former assessment as dry, but were charged with a consolidated assessment which was equivalent either to the average of the wet lands in their immediate neighbourhood, or, more generally perhaps, to the average wet rate of the whole village.

* Repally and Bapatla.

5. In the year before anicut irrigation the average "wet" rates of Repally and Bapatla were Rupees 5 and Rupees 5-8-0 respectively. In 1872-73, that is, the year prior to the introduction of a new settlement which distinguished between "land assessment" and "water-rate," the average "wet" rates were respectively Rs. 4-6-0 and Rupees 5-6-0, and the average rates for "dry converted into wet" Rupees 5-9-0 and Rupees 5-2-0 respectively. In this delta the amount to be credited to the anicut in the case of dry lands converted into wet might be arbitrarily determined by assigning to it the product of the whole area converted multiplied by the water-rate, the remainder of the assessment of such lands being credited to land assessment and not assigned to the anicut on the supposition that when converted they were already in occupation. The assessment of dry lands converted into wet appear in the taluq accounts only in a consolidated form; there is no record there of the amounts to be assigned to land assessment and to water-rate respectively.

6. The arbitrary division here suggested as possible was not adopted in the statements submitted with my letter of 28th ultimo; these statements, in accordance with the instructions of the memorandum attached to Board's Proceedings, No. 283, dated 31st January 1876, compared the total irrigated land revenue before and after anicut irrigation and assigned the difference between the two to that work.

7. This method of determining the effect of anicut irrigation is quite as arbitrary as the other; in both there is the very great probability that something really due to land assessment is credited to the anicut, but in choosing between two arbitrary methods that is to be preferred which is most in accordance with the revenue system of the province, that is to say, the method of the statements is the preferable one.

8. Neither the Secretary of State nor the Government of India appear to expect for this Presidency returns for the past which are mathematically exact; the Revenue system of account that existed prior to the new settlements makes such returns simply impossible. What is wanted seems to be a statement of account for past years, which, based on the best information available, may be considered to be fairly accurate.

9. Should Government think that a further and more elaborate investigation is necessary for the more accurate determination of the revenue results of anicut irrigation than is afforded by the statements submitted with my letter, No. 2, dated 28th March 1876, I would observe that for the Eastern Delta no amount of investigation would elicit any better information than is now available, and that for the Western Delta the inquiry, if entered upon, would involve the detailed examination of village accounts for every year after and many years before anicut irrigation ; this would be a long labor ; how long I should be afraid to say ; and it is for Government to consider whether the results that *may* be obtained are worth the time, labor, and money to be spent in trying to get them. At best, for the scheme as a whole success must be but partial. However accurately the results of anicut irrigation in the Western Delta may be finally determined, for the Eastern Delta they must for ever remain, if not uncertain, incapable of exact demonstration.

10. These considerations lead me to suggest that for the Kistna the Revenue results embodied in the statements already submitted be accepted for the past, and that for the other great works for which similar accounts are required statements drawn up on the same principles be prepared.

11. The statements for the Kistna are defective chiefly in the matter of the distribution and adjustment of charges.

12. The Controller of Public Works Accounts may at some future time be able to substitute for the estimated charges for Department of Public Works Establishments and Tools and Plant, that I have made more accurate figures, and the statements may then be modified in accordance with the changes which his distribution and adjustment of charges may render necessary, but, in the meantime, I see no reason why these statements should not be taken as a fairly accurate account of the financial results of irrigation in the Kistna.

13. For the preparation of revenue accounts of irrigation on the method adopted in these statements there can be none better fitted than the Collectors of the districts in which the work lie.

14. The labor of superintending and directing a few extra Accountants would add but little to their ordinary work.

15. Should Government still think that it is desirable to have the services of a special officer for this work, I shall proceed to the detailed examination of the accounts of the villages in the Kistna Deltas.

No. 283. ORDER THEREON, 17th June 1876, No. 1,504.

IRRIGATION, No. 21.

Members and Secretary of the Board of Revenue.
Chief Engineer for Irrigation.
J. Wilson, Esq., on Special Duty.
Examiner of Public Works Accounts.
Deputy Examiner of Public Works Accounts, Irrigation Branch.

HIS GRACE the Governor in Council has had under consideration the Proceedings of the Committee assembled for the purpose of considering the best means of giving immediate effect to the wishes of the Government with regard to the preparation of the Capital and Revenue Accounts of the Irrigation Works in this Presidency. After a careful consideration of the opinions of the members of the Committee, together with the previous correspondence on the subject, His Grace the

Governor in Council has arrived at the following conclusions with regard to that part of the question which will be dealt with in the Public Works Department. The basis on which the Revenue receipts due to Irrigation should be calculated will form the subject of a separate order.

2. In the first place the Government consider it advisable to limit the number of Irrigation Works for which separate Capital and Revenue Accounts are to be kept, and in this view the preparation of these Capital and Revenue Accounts will be for the present confined to the following eight works, *viz.* :—

Godavery Delta Works.	Palar Anicut.
Kistna do. do.	Pelandorai Anicut.
Pennair do. do.	Cauvery Delta Works.
Chembrumbaukum Tank.	Strivaiguntum Anicut.

3. For these eight works the Capital and Revenue Accounts will be prepared in accordance with the forms and the classifications prescribed by the Government of India, but as, in the case of the Chembrumbaukum tank, this classification would make the most important work of the project a sub-head of main canals and branches, while the latter are really only subsidiary to the tank, the Government of India will be requested to decide whether it would not be better to adopt an additional main-head, which might be called (2A.) Reservoirs, rather than introduce this anomaly. Similarly it seems to be desirable, looking to the number of tanks in the Strivaiguntum Anicut Project which are dependent upon distributaries, and which are really works of distribution, to introduce the sub-head " N Tanks and Reservoirs " under the main-head (3) Distributaries, and on this point also the wishes of the Government of India will be ascertained. It may be added that there are numerous other Irrigation works for which Capital and Revenue Accounts are not for the present to be maintained, but for which classification of expenditure will be necessary, in connection with which the sub-head N, under (3) Distributaries, would be convenient.

4. Following the decision to restrict the number of works for which separate Capital and Revenue Accounts are to be maintained, the expenditure on all works other than the eight irrigation systems above specified will, for the present, be exhibited in the financial accounts under the head Ordinary Agricultural. The Examiner will, however, arrange to record separately under the 'classes,' 'Original Works,' 'Repairs,' &c., &c., the expenditure on any large works for which Capital and Revenue Accounts may hereafter be required or for which the Government may require separate accounts for administrative purposes.

5. But whilst the Government is resolved that no further delay shall occur in taking practical measures for the preparation of these accounts, His Grace the Governor in Council considers it absolutely necessary to commence by placing the record of current expenditure on a proper footing, and that in no other way can the work be carried to a satisfactory conclusion. It is only by actually bringing into operation the necessary forms and procedure in connection with current expenditure that it is possible to realize exactly what has to be done in regard to the past, and this Government believes that any attempt to commence with the past accounts before placing current transactions on a proper footing will only lead to an indefinite postponement of the proper accounting for present transactions without in any way expediting the completion of these accounts as a whole.

6. The Chief Engineer for Irrigation will as soon as possible submit to Government a list of all the different works or systems for which separate accounts, under Ordinary Agricultural, should, in his opinion, be kept, and for such works as may be approved by Government, he will obtain and send to the Examiner of Accounts properly classified descriptive lists of all the individual works which form the component parts both of these systems, and also of the eight large Irrigation schemes for which Capital and Revenue Accounts are to be maintained. These lists cannot probably be at once furnished complete, but no time should be lost in furnishing all the information at present available, and in taking such steps as may be necessary to supply all deficiencies of detail, and the Chief Engineer for Irrigation will report to what extent this requirement may be met at once.

7. As this information will be of little or no practical use unless made readily available, the Examiner, in communication with the Chief Engineer for Irrigation, will have these lists of works printed off as soon as received, and will supply copies of them to all those who have to deal with these Irrigation statistics.

8. As soon as the necessary information regarding any one system of works is complete, the Examiner, after opening Administrative Accounts for current expenditure, will at once commence on the accounts of the past in such detail as may now be found practicable. The Examiner, in communication with the Chief Engineer, will also make arrangements for securing agreement between the accounts in his own office and the registers maintained in the offices of the District Engineers for recording the expenditure on tanks and other minor Irrigation Works.

9. The Examiner will now submit proposals for the establishment required for carrying out the work in connection with the Capital and Revenue Accounts of Irrigation Works.

(True Extract.)

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 284. DOCKET No. 1,505, dated 17th June 1876.

COPY of the above forwarded to the Government of India.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following :—

No. 71 W.

No. 311. *Note by the Chief Engineer for Irrigation.*

THE Officiating District Engineer, Tinnevelly, forwards, with his letter marginally noted, an estimate in connection with the Vellur Tank situated in the Tenkarai Taluq, Tinnevelly Range.

No. 2, dated 1st April 1876.

2. The nature of the work proposed for execution and the heads of account to which it is chargeable are as follow :—

Ordinary—Agricultural.

	RS.
Improving and extending the existing calingulah and converting it into a weir. Original Works	5,315
Rebuilding a ruined calingulah and converting it into a weir. Repairs	4,620
Improving the Kunmarukal calingulah and converting it into a weir. Repairs	735
Constructing two irrigation sluices to replace the old ones. Repairs.	380
Raising the bund and repacking the old rough stone revetment and repairing the existing irrigation sluices. Repairs... ...	6,350
Total ...	17,400

3. The following particulars of this tank are recorded :—

Ayacut Area	Acres	$\frac{2179}{8952}$
Assessment	Rs.	$\frac{23,143}{95,605}$
Average revenue, not stated.		
Highest do., do.		
Expenditure during the previous four years...	"	$\frac{1612}{9575}$

The works provided for the discharge of surplus appear to be in excess of the actual requirements. The area of country draining into the tank is stated to be 30 square miles, and the maximum flood discharge may, it is thought, be assumed to be about 4,342 cubic feet a second, and with two feet going over the weirs a length of 455 feet will suffice.

$$d = 450 \times 30^{\frac{3}{4}}.$$

4. There are at present—

1. A short calingulah 42 feet which is proposed to be reconstructed as a surplus weir at a cost of Rupees 720.
2. A calingulah 245 feet long, between this tank and the Tenkarai Tank which is in ruins and which it is proposed to rebuild with a length of 330 feet at a cost of Rupees 4,520.
3. A surplus weir, 155 feet long, at the west end of the bund which it is proposed to lengthen to 315 feet. Estimate Rupees 5,195.

The crest of the 42 feet weir is intended to be 1 foot above F.T.L., probably because the discharge from it runs over cultivated land. The effect of this weir in relieving the tank will be so small that it may be left out of the calculation. The 155 feet weir appears to be in working order, and it may be retained as it is. The length of surplus weir, No. 2 required, will then be 300 feet, and the work as designed being 330 feet long will be all that is necessary; but the following modifications should be made :—

1st.—The crest wall should be at F.T.L. throughout instead of being raised over the sluice vents.

2nd.—The cut-stone facing in rear of the crest wall should be omitted. Brick-work at 5 Rupees a cubic yard ought to be quite good enough.

3rd.—The shutter planks for the sluices should be 2 inches thick only. It is to be noticed that 3½ Rupees a cubic foot are entered for "Congoo" wood, and this rate would be high for teakwood.

The estimate as revised amounts to Rupees 3,710.

5. The estimate for repairing the bund has an item for repacking the revetment, the rate being 12 Annas a cubic yard, which is about double what is usual. On the

other hand no backing to this revetment is provided for, and it is improbable that the soil of the bund is such as to allow of its omission.

There is but one rate for earthwork, and that a very high one, *viz.*, 1½ Annas a cubic yard. This should be examined into.

The repair of eleven out of seventeen sluices is provided for, but it is not clear whether the estimate for two new sluices is in both cases for the reconstruction of formerly existing sluices, though from the heading of the plan this would seem to be the case.

The items recommended for sanction are—

ORDINARY, AGRICULTURAL.

Original Works.

	RS.
Constructing a weir	3,710
Do. two sluices	390
Total, Original Works ...	4,100

Repairs.

Repairs to bund...	4,500
Do. to sluices	1,860
Do. and improvements to Kunmarukal surplus weir	750
	7,110

The construction of the weir, Rupees 3,710, should be entered in Budget of 1877-78, the amount being in excess of the limit (Rupees 2,500) for Minor Works. The sluices can be built from the District grant for Minor New Works.

(Signed) A. DEC. SCOTT, Major, R.E.,
Depy. Chief Engineer for Irrigation,
for *Chief Engineer for Irrigation.*

12*th June* 1876.

No. 312. ORDER THEREON, 20th June 1876, No. 1,520.

IRRIGATION, No. 22.
Account.

The following estimate from the Tinnevelly Range, forwarded by the District Engineer, Tinnevelly, is sanctioned.

VELLUR TANK.

IRRIGATION.

Ordinary, Agricultural.

			RS.
No. 48 I of 1876-77.	1.	* Constructing a weir. Original Works ...	3,710
	2.	„ two sluices „	390
	3.	Repairs to bund. Repairs	4,500
	4.	„ to sluices. „	1,860
	5.	„ and improvements to Kunmarukal surplus weir. Repairs...	750
		Total ...	11,210

* Item No. 1 for entry in the Budget of 1877-78.

2. This sanction has been registered as No. 48 I of 1876-77

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 317. Read the following letter from Lieutenant D. McNEIL CAMPBELL, R.E., Executive Engineer in charge of Godavery District, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Dowlaishweram, 7th June 1876, No. 663 :—

WITH reference to G.O., No. 2,936, dated 14th October 1875, I have the honor to request that I may be allowed to take advantage of the first high freshes in the river to send the Steamer *Prince* over the anicut, so that she may be taken down to Cocanada to be handed over to the Marine Department.

No. 318. ORDER THEREON, 20th June 1876, No. 1,523.

IRRIGATION, No. 23.
Account.

APPROVED, and communicated to the Marine Department in continuation of G.O., No. 2,936, of 14th October 1875, and No. 3,235 of 13th November.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following :—

No. 73-W.

No. 329. *Note by the Chief Engineer for Irrigation.*

THE District Engineer, Salem, forwards, with his letter marginally noted, an estimate in connection with the Yellareddy Tank situated in the Ossoor Taluq, No. 2 or Ossoor Range.

No. 8, dated 26th April 1876.

2. The nature of the work proposed for execution and the heads of account to which it is chargeable are as follow :—

	RS.
Raising and repairing the bund. Revenue Repairs...	238
Widening the surplus channel and revetting the same with rough stone. Revenue Extensions and Improvements	20
Reconstructing an Irrigation sluice. Revenue Extensions and Improvements	78
Total ...	336

3. The following particulars of this tank are recorded :—

Ayacut area	Acres 18
Assessment	Rs. 95
Average revenue	„ 67
Highest do.	„ 84
Expenditure during the previous four years	*Nil.*

The area of the catchment basin is one square mile; the maximum flood supply is calculated at 562 cubic feet per second, for discharging which as surplus there is a channel 24 feet in width, it is proposed to increase the width of the channel by 8 feet, which would make a total width of 32 feet available for the surplus discharge. The estimate also provides for reconstructing the irrigation sluice and for raising, repairing, and revetting the bund where necessary.

4. G.O., No. 2,193, dated 28th July 1875, directed that further information should be given respecting this tank in order to warrant its repair, the outlay proposed for which, though actually not considerable, was large relatively to its average revenue.

The District Engineer states in the letter under reference that the Collector considers the preservation of the tank of importance, as it is a source of water supply for drinking purposes to the adjacent villages. The repairs are also necessary for the conservation of the revenue. The estimate is accordingly recommended for sanction. The distinction between what may be considered new work and repairs has not been sufficiently clearly maintained, but the amount debitable to the former head is so trifling that the whole estimate may be charged as a repair.

(Signed) A. DEC. SCOTT, Major, R.E.,
Dy. Chief Engineer for Irrigation,
for *Chief Engineer for Irrigation.*

12*th June* 1876.

To the Secretary to Government, Public Works Department.

No. 330. ORDER THEREON, 20th June 1876, No. 1,529.

IRRIGATION, No. 23A.

Account.

THE following estimate from the No. 2 or Ossoor Range, forwarded by the District Engineer, Salem, is sanctioned:—

YELLAREDDY TANK.

Irrigation.

		RS.
49-I. of 1876-77. ...	1. Raising and repairing the bund. Revenue I.B. Maintenance and Repairs	238
	2. Widening the surplus channel and revetting the same with rough stone. Revenue I.B. Maintenance and Repairs	20
	3. Reconstructing an Irrigation sluice. Revenue I.B. Maintenance and Repairs	78
	Total ...	336

2. This sanction has been registered as No. 49-I., of 1876-77.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 341. Read the following endorsement of the Chief Engineer for Irrigation, dated Ootacamund, 27th May 1876, No. 25 :—

From J. H. LATHAM, Esq., Chief Engineer and Manager of the Madras Irrigation and Canal Company, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Ootacamund, 25th May 1876, No. 48.

April Reports.

I HAVE the honor to forward, herewith, copies of the Upper and Lower Divisions Reports, together with my own, for the month of April 1876.

MADRAS IRRIGATION AND CANAL COMPANY, UPPER DIVISION.

Monthly Report for April 1876.

1. *Water.*—The head sluices were closed and the under sluices opened on the 1st of May, but on the 26th the water had fallen below the cill of head sluice. Water has fallen very low at Lockinsula, and will in a day or two altogether subside. The timely rains of March have saved nearly all the crops in my division.

2. The *weather* has been distressingly hot, and the severe outbreak of cholera in the villages round Kurnool and in the Nundicotkur Taluq have had a most retarding effect on all the preparations which were to have been made for the *one month* during which the canal is without water. In consequence of this the whole of the earth work on the four bridges above Kurnool have been delayed, together with many other important works, which will, I fear, have to be curtailed in extent if water is let in on the 1st of June.

3. *Irrigation.*—The following statement has been prepared to show the amount of this year's irrigation :—

Taluq.	At 1 R. per Month per Acre.	At 1¼ R. per Month per Acre.	At 2 Rs. per Acre.	At 3 Rs. per Acre.	At 4 Rs. per Acre.	At 5 Rs. per Acre.	At 6 Rs. per Acre.	At 12 Rs. per Acre.	Total Area of Columns 2 to 9.
1	2	3	4	5	6	7	8	9	10
	A. C.	A. C.	A. C.	A. C.	A. C.	A. C.	A. C.	A. C.	A. C.
BAMALACOTA TALUQ.									
1st Crop ...	14 81	0 00	3 00	122 23	148 14	12 23	366 92	0 00	667 33
2nd ,, ...	21 93	2 57	0 75	24 52	99 28	0 23	71 90	0 00	221 18
Total ...	36 74	2 57	3 75	146 75	247 42	12 46	438 82	0 00	888 51
NUNDICOTKUR TALUQ.									
1st Crop ...	0 00	0 00	41 97	826 57	876 44	551 07	516 86	0 75	2,813 66
2nd ,, ...	97 06	16 94	14 01	62 66	141 52	8 11	27 80	0 00	368 10
Total ...	97 06	16 94	55 98	889 23	1,017 96	559 18	544 66	0 75	3,181 76
NUNDIAL TALUQ.									
1st Crop ...	0 00	0 00	5 45	544 97	199 87	90 59	63 69	0 00	904 57
2nd ,, ...	95 14	1,051 32	1 93	103 93	79 99	26 34	16 42	0 00	1,375 07
Total ...	95 14	1,051 32	7 38	648 90	279 86	116 93	80 11	0 00	2,279 64
Grand Total ...	228 94	1,070 83	67 11	1,684 88	1,545 24	688 57	1,063 59	0 75	6,349 91

4. *Tanks.*—About 815 acres of Nundial Government tank lands have been irrigated from the canal during the last month. As soon as the water in this tank fell below the level of a sluice cill, channels were directed to the sluice through the dry bed of the tank, so as not to

interfere with the original supply. Water has also been supplied to Canalla and Billalapooram lands in a similar manner.

5. *Settlement.*—The Special Deputy Collector in charge of Irrigation is deputed to hold the settlement towards the end of the month, after settling some of the Lower Division Taluqs with Mr. Dunphy.

6. *Repairs.*—It is hoped that during the month the head works will be put in order; also a new pair of deep sluices will be built in Calingula No. 1 to replace the old under sluices which were not well adopted to the work. Several important repairs will be made on account of navigation; of these, the heaviest will be the repairs to the lock gates and fittings which have been standing five years untouched, except the occasional cleaning and tarring.

7. *Constructions.*—On Capital account the chief works are Singavaram and Moochoomurry bridges. In the former the piers can now be commenced as water had subsided. At the latter I hope to get up the centrings by the end of the month.

8. *Health.*—No important cases have occurred fortunately; only one banker died of the epidemic.

9. The staff were paid from the 8th to 18th April 1876.

(Signed) C. H. WILKS,
Conservancy Engineer.

MADRAS IRRIGATION AND CANAL COMPANY, LOWER DIVISION.

Report for the month of April 1876.

On the 30th April the head sluices at Rajoly and Adimapully were closed, in accordance with the advertisements inserted in the District Gazettes, for the purpose of commencing the repairs to the locks, culverts and aqueducts, and for the removal of silt.

2. The latter work cannot be commenced before the 10th of May, the silt being too wet to work at present, but every thing necessary is in readiness, and I hope to complete it before the heavy rains.

3. Several of the masonry waterways which excited suspicion have been examined and found requiring repair, especially those where the water has a drop. One of these, the Canagoodoor culvert, 138 miles 9 chains, after constant and fatiguing baling with baskets day and night, to get rid of the water which flows constantly throughout the year, was found to be in such a state, that immediate repair was necessary to render it safe to pass an ordinary flood. The floor was not only carried away, but the natural soil in the middle of the arches was scoured out to an average depth of 3 feet below the foundation, and in some places the masonry of the piers were over-hanging 8 inches, of one place 1 foot 9 inches, and at another the masonry was completely undermined.

4. The drop walls were in places carried away, and it is owing to this principally that the injury was so great.

5. With the exception of the floors which are hardly necessary, the needful repairs and additions have been carried out.

6. There are two other similar culverts under which the water is standing to a depth of over 5 feet, which from soundings appear unsafe. The great difficulty to contend with is the water.

7. One of these, which beyond doubt, should not be neglected another season, I am unable to examine and repair at present, owing to a bund having been placed across the outlet to dam up the water for gardens; and until arrangement can be made with the gardeners, the water cannot be drained off from the culvert.

8. The repairs to other culverts now being carried out are comparatively light and consist of pointing, slight masonry repairs.

9. The removal of silt from arches, &c., is being carried out; from one 3-arch culvert 9 feet span, as much as 312 yards were cleared out in order to leave a fair waterway.

10. I am glad to say that the foundations of the large aqueducts—the Vakilar, Punkala Wunka, and Peechapaud—are found to be perfectly sound and uninjured.

11. The anicuts and head works at Rajoly and Adimapully have been examined, and found in no need of repair beyond pointing.

12. The locks are now undergoing repairs, and before the water is again let into the canal, I hope to have the masonry repaired, and every necessary bolt supplied.

13. The raising of banks, particularly at the 177th mile, is nearly completed. For a distance of 44 chains the banks require raising an average of 1 feet 6 inches, and the width increased from about 3 feet to 6 feet.

14. The banks were not originally made to the normal dimensions.

15. At the 176th mile the banks are in a similar condition, and must be raised.

16. Side drains to carry off standing water are being made, and existing ones are being cleared out, the latter work being chiefly done by bankers.

17. This month the bankers have been principally engaged in stopping cracks in the banks, which in some soils, particularly the black cotton, are very troublesome, and require constant attention until the rains commence.

18. Several of the main channels are undergoing repairs, and since the water has ceased flowing in the channels, several bridges have been commenced, the material having been collected some time ago.

19. *Irrigation.*—I enclose my monthly statement, showing the entire season's irrigation. Up to the end of the month the Ameen's attached to the 10th Section have been busy recording and measuring, as the applications for indigo have been very numerous during even the month of April.

20. There is a great increase of applications for water for this crop in the Cuddapah and Prodatoor Taluqs, and it should extend to the Sirwell Taluq, and will I think.

21. The Lower Division were paid between the 7th and 13th April 1876.

(Signed) J. O. DUNPHY,
Acting Conservancy Engineer.

DHOOR,
7th May 1876.

IRRIGATION RETURN IN ACRES UP TO END OF APRIL 1876.

Lower Division.

	Rate per Acre.	Sirwell Taluq. 1876.	Sirwell Taluq. 1875.	Koilkuntla Taluq. 1876.	Koilkuntla Taluq. 1875.	Jumbulmadugu Taluq. 1876.	Jumbulmadugu Taluq. 1875.	Prodatoor Taluq. 1876.	Prodatoor Taluq. 1875.	Cuddapah Taluq. 1876.	Cuddapah Taluq. 1875.	Divisional Total Areas in Acres. 1876.	Divisional Total Areas in Acres. 1875.	Total Amount, 1876.	Total Amount, 1875.	Remarks.
	RS.													RS. A. P.	RS. A. P.	
1st crop or half double crop.	6½	...		...		...		...		...		...		...		
	6	359·58		55·21		...		193·33		326·58		934·70		5,608 3 2		
	5	245·19		51·24		...		206·65		144·72		647·80		3,239 0 0		
	4½	...		...		...		...		...		...		...		
	4	409·30		74·52		17·80		809·73		1,026·21		2,337·56		9,350 3 10		
	3	626·16		66·89		22·10		230·98		132·75		1,078·88		3,236 10 3		
	2½	...		...		...		...		...		...		...		
	2	5·98		...		1·13		52·71		102·95		162·77		325 8 8		
	1½	...		...		...		110·02		8·52		118·54		177 13 0		
	1	...		...		...		98·90		99·69		198·59		198 9 5		
	½	...		...		...		...		...		...		...		
	Other ...	...		...		...		...		90·00		90·00		*360 0 0		* At Rs. 4 per acre. Sub-soil leakage.
	Disputed ...	688·68		0·20		...		21·94		...		710·82		...		
	Total ...	2,334·89	1,691·16	248·06	357·67	41·03	53·12	1,724·26	3,216·38	1,931·42	2,845·47	6,279·66	8,163·80	22,496 0 4	Rupees 25,144 15 10	
2nd crop or half double crop.	7½	...		...		...		6·47		...		6·47		48 8 4		
	6½	...		...		...		16·86		11·08		27·94		181 9 9		
	6	60·89		20·00		...		25·91		4·77		111·57		669 6 9		
	5½	...		...		...		62·43		...		62·43		342 5 10		
	5	92·19		13·49		...		...		...		105·68		528 6 5		
	4½	...		...		...		116·25		2·11		118·36		532 9 10		
	4	235·11		21·51		...		14·55		...		271·17		1,084 10 11		
	3	101·03		10·65		...		346·27		...		457·95		1,373 13 7		
	2½	...		...		...		...		41·98		41·98		102 15 10		
	2	10·79		...		...		374·81		...		385·60		771 3 2		
	1½	29·39		...		...		7·32		56·74		93·45		139 11 7		
	1	171·04		31·72		22·41		197·95		1,506·59		1,929·71		1,929 11 4		
	Other ...	...		...		...		...		...		...		...		Sub-soil leakage.
	Disputed ...	4·83		...		...		...		...		4·83		...		
	Total ...	705·27		97·37		22·41		1,168·82		1,623·27		3,617·14		7,705 1 4		
	Grand Total ...	3,040·16	1,691·16	345·43	357·67	63·44	53·12	2,893·08	3,216·38	3,554·69	2,845·47	9,896·80	8,163·80	30,201 1 8	25,144 15 10	

The above agrees with my Office Records.

(Signed) J. O. DUNPHY,
Acting Conservancy Engineer.

MADRAS IRRIGATION AND CANAL COMPANY.

Chief Engineer's Report to accompany the Divisional Reports for April 1876.

The irrigation under the canal, as shown in the lists of the Company's Officers prepared for the settlement now pending, is—

2. 16,246·63 acres, at Rupees 53,239 water-rate, so that the income of the canal will be about Rupees 60,000. Had it not been for the unusual fresh at the end of last month, the amount would have been much lower. This fresh both saved a good deal of crop, and so prevented remission, and also supplied much new crop, and filled several tanks. This, however, did not prevent the season being on the whole a bad one, for the early cessation of water in January made the ryots justly cautious about sowing any second crop dependent on irrigation if they could avoid it.

3. The irregular practices in the Lower Division have received careful attention. Modifications of the rules, in order to make them more simple and effective, have been agreed upon by the Acting Collectors of Kurnool and Cuddapah; and it is intended that further issues for adoption or discussion shall be decided upon at the settlement now commenced, so that the whole may be shortly submitted to Government. Mr. Gribble has invited me to meet him to discuss this subject, and I hope to do so next week. Mr. Foster is also starting presently to satisfy himself personally about the matter.

4. The character of the works now in hand is shown in the divisional reports. The season has been hot; but it is now only 93° in a closed house, and there is usually a nice breeze. Yet cholera is still severe, and I thought it well to visit the canal and see that every provision and arrangement is made for smoothing the progress of repairs and enabling the Engineers to work with the least possible anxiety and correspondence. I shall see Mr. Dunphy's culverts next week.

5. Except once at Kurnool, there was nothing to call a shower during the month.

6. I am glad to report that cholera seems to have almost entirely avoided the Company's Staff; perhaps they are no great eaters of melons and mangoes. I believe the bad fruit (due to the bad season), such as I have seen exposed for sale in a very unsatisfactory condition, is found by the medical authorities here to be the apparent cause of many attacks of a choleraic kind.

7. The usual table of rainfall accompanies this report.

KURNOOL,
17*th May* 1876.

(Signed) J. H. LATHAM,
Chief Engineer and Manager.

Register of Rainfall in Inches and Decimals of the following Stations during the month of April 1876 *at* 6 A.M. *daily.*

Month and Date.	Soonkasala.	Kurnool.	Jupaud.	Veelapanore.	Jutoor.	Ayaloor.	Chintacoonta.	Rajoly.	Dhoor.	Adimapully.
1st April 1876 ...	...	...	...	...	...	...	...	...	...	...
2nd " " ...	...	...	...	...	...	...	...	...	...	...
3rd " " ...	...	...	...	...	...	...	...	...	...	...
4th " " ...	...	0·63	...	...	...	...	...	...	...	...
5th " " ...	...	...	...	...	...	...	...	...	...	...
6th " " ...	...	...	...	...	...	...	...	...	...	...
7th " " ...	...	...	...	...	...	...	...	...	...	...
8th " " ...	...	...	...	...	...	...	...	...	...	...
9th " " ...	...	...	...	...	...	0·23	...	...	...	...

Register of Rainfall in Inches and Decimals of the following Stations, &c.—(Concluded.)

Month and Date.	Soonkasala.	Kurnool.	Jupand.	Veelapanore.	Jutoor.	Ayaloor.	Chintacoonta.	Rajoly.	Dhoor.	Adimapully.
10th April 1876 ...	...	0·34	...	0·30	...	...	...	...	...	...
11th " " ...	...	...	...	...	...	...	...	...	...	...
12th " " ...	...	...	...	...	...	...	...	...	...	...
13th " " ...	...	...	...	...	...	...	...	...	...	...
14th " " ...	...	...	...	...	...	...	...	...	...	...
15th " " ...	...	...	...	...	...	...	...	...	...	...
16th " " ...	...	...	...	...	...	...	...	...	0·25	...
17th " " ...	...	...	0·10	...	...	...	...	...	...	...
18th " " ...	...	...	...	...	...	...	...	...	...	...
19th " " ...	...	...	...	...	...	...	...	...	...	...
20th " " ...	...	...	...	...	...	...	...	...	...	...
21st " " ...	...	...	...	...	...	...	...	...	...	...
22nd " " ...	...	...	...	...	...	...	...	...	...	...
23rd " " ...	...	...	...	...	...	...	...	...	...	...
24th " " ...	...	...	...	...	...	...	...	...	...	...
25th " " ...	...	...	...	...	...	...	...	...	...	...
26th " " ...	...	...	...	...	...	...	...	...	...	...
27th " " ...	...	...	...	...	...	...	...	...	...	...
28th " " ...	...	...	...	...	...	...	...	...	...	...
29th " " ...	...	...	...	...	...	...	...	...	...	...
30th " " ...	...	...	...	...	...	...	...	...	...	...
Total ...	...	0·97	0·10	0·30	...	0·23	...	...	0·25	...

KURNOOL,
17*th May* 1876.

(Signed) J. H. LATHAM,
Chief Engineer and Manager.

SUBMITTED for the information of Government.

A memorandum of proposed revision of the rules, with explanatory notes of the Chief Engineer and Manager, was received a short time ago, and arrangements had been made for printing the existing and proposed rules and the remarks side by side for submission to Government; as it now appears however that further revision is contemplated, the submission of the papers to Government will be postponed.

With letter, No. 37, dated 4th May 1876.

2. It is not understood in connection with the foregoing remarks how the conclusion is arrived at, in paragraph 5 of the Report of the Lower Division, that flooring to the culvert referred to is hardly necessary. If the floor was carried away as mentioned in paragraph 3, not only is such a protection apparently necessary, but it needs to be constructed more substantially than before.

3. Paragraphs 14 and 15 show that the low banks referred to in a former report* were not originally properly completed.

* That for March 1876, G.O., No. 1,123, 8th May 1876.

4. It will be seen that the Chief Engineer's estimate of irrigation for 1875-76, based upon the Canal Officer's returns, is—

Acres	16,246
Rupees	53,239

and from the Divisional Reports this is distributed as follows:—

		ACRES.	RS.
Upper Division	... ...	6,349·91	23,038*
Lower „	... ...	9,896·80	30,201
		16,246·71	53,239

* Not stated in the Upper Division Report; balance entered.

(Signed) JOHN MULLINS, Lieut.-Colonel, R.E.,
Chief Engineer for Irrigation.

No. 342. ORDER THEREON, 20th June 1876, No. 1,535.

IRRIGATION, No. 23-AA.

RECORDED. The attention of the Chief Engineer and Manager will be drawn to paragraph 2 of the endorsement by the Chief Engineer for Irrigation.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following:—

No. 67 W.

No. 343. *Note by the Chief Engineer for Irrigation.*

THE following estimates from the No. 3 or Chingleput Range are forwarded by the Superintending Engineer, Chingleput, with his letters marginally noted:—

No. 4,677, dated 28th February 1876.
„ 451, „ 13th May 1876.

Taluq.	Village.	Work.	Amount.
			RS.
Chingleput	Govinda Medu ...	S. No. 231 V. Tank	765
Conjeveram	Padur	S. No. 302 V. Tank	532

2. The financial and hydraulic details of the Irrigation works concerned are exhibited in the following statement:—

I.—Financial Details.

Name of Work.	Ayacut Area.	Assessment.	Average Revenue for 5 years.	Highest Revenue for 5 years.	OUTLAY: During the previous 4 years.	OUTLAY: Proposed: Capital.	OUTLAY: Proposed: Revenue.	OUTLAY: Proposed: Average Annual Proportion of Charges to Revenue.
	ACRES.	RS.	RS.	RS.	RS.	RS.	RS.	RS.
Govinda Medu Tank	166	341	400	495	Nil.	...	765	38·3
Padur Tank	56	412	441	565	Nil.	...	532	24·1

II.—Hydraulic Details.

Name of Work.	Catchment Basin Area.	Maximum Supply.		Length of Escape.		Average Height of Bund.		Surplus discharged at M.T.L. per Sec.	Tanks above.
		Catchment per Second.	Channels per Second.	Total.	Effective.	Above F.T.L.	Above M.T.L.		
	SQ. M.	C. FT.	C. FT.	FT.	FT.	FT.	FT.	C. FT.	NO.
Govinda Medu Tank ...	2	893	...	E 220 E 200	220 200	3·50 5·00	1·50 3·00	1,393·7 950·3	...
Padur Tank	0·538	370	...	C24 W 24	11·5 24	3·75 4·25	1·00 1·50	349·8 367·7	Not stated.

NOTE.—The proposed dimensions of escapes and heights of bund are printed in large type, the existing dimensions in small type. The following abbreviations are used :—C.—Calingulah with dam stones. W.—Weir with flush crest. E.—Escape at ground-level. B.—Bund of tank.

3. The following is a summary of the work proposed to be carried out in each case :—

Govinda Medu Tank.—Raising and repairing the bund, and forming an escape planted with grass, and reconstructing an irrigation sluice.

Padur Tank.—Raising and repairing the bund, repairing two irrigation sluices, planting grass, repairing and converting the calingulah into a weir.

4. The vent of the sluice to be reconstructed in the bund of the Govinda Medu tank is unnecessarily large. The head of the aperture may be lowered 1½ feet with advantage. This will enable the plug-hole also to be placed at a lower level, thus increasing its discharge and enabling it to be used for a longer time.

5. The arrangement of the plug-holes of the sluices of the Padur tank is apparently incorrectly shown on the sections, and this should be seen to before the work of reconstruction is carried out. The rear wall and wings may be much reduced if the bund be placed as shown by the dotted lines, and if this be impracticable, the sluice tunnel should be lengthened 12 feet, and then a low wall and wings will suffice. The design manifestly does not satisfy the conditions of the site. The Superintending Engineer should not have passed on a plan so drawn. The Range Officer says that the crest of the surplus weir is 1 foot above proper full tank level, and apparently he has come to this conclusion on the ground that the tank at the reduced level will hold more than enough water for the cultivation. The discharge shown is equivalent to 25 inches of rainfall drainage in twenty-four hours, and it is thought that the tank will be quite safe if the crest be lowered 6 inches. It is intended to close the sluice vents in the weir, but, unless there be some adequate reason for so doing, it may be as well to retain them.

6. The Range Officer has supplied a survey of the catchment basin of the tank and has contoured the tank bed. The calculated content which has also been noted should have been made out by calculating the arrears described by the contours at each level and finding the content of the section cut off by the plane of each contour. Apparently the arrears of the cross sections have been taken and multiplied by the horizontal distances between them. The data afforded by the contours and survey

will be useful, and it is satisfactory to notice that the Range Officer has taken the pains to carry out the investigation.

7. The estimates are recommended for sanction.

8. The following statement shows the proposed distribution of the outlay recommended for sanction, to the debit of the several heads of account involved :—

Name of Tank.	Items of Estimate.	FUND.			
		Capital, Ordinary.	Revenue. Extensions and Improvements.	Revenue. Repairs.	Total for each Tank, &c.
		RS.	RS.	RS.	RS.
Govinda Medu Tank ...	Raising and repairing the bund, and forming an escape planted with grass.	...	...	470	765
	Reconstructing an irrigation sluice ...	...	...	295	
Padur Tank	Raising and repairing the bund, planting grass, repairing the two irrigation sluices	...	...	532	532
	Repairing and converting the calingulah into a weir...	...	...		

(Signed) A. deC. SCOTT, Major, R.E.,
Depy. Chief Engineer for Irrigation,
for *Chief Engineer for Irrigation.*

OOTACAMUND,
7th June 1876.

To the Secretary to Government, Public Works Department.

No. 344. ORDER THEREON, 20th June 1876, No. 1,536.

IRRIGATION, No. 23-AAA.

Account.

No. 67 W., dated 7th June 1876.

THE following estimates for Irrigation Works in the No. 3 or Chingleput Range, Chingleput District, forwarded by the Chief Engineer for Irrigation with his memoradum marginally noted, are sanctioned :—

Irrigation.

Name of Work.	Item of Estimate.	Fund.	Amount.	Irrigation Registry No.
			RS.	
Govinda Medu Tank...	Raising and repairing the bund, and forming an escape planted with grass.	Ordinary Agricultural. Repairs.	470	1 } 50 I.
	Reconstructing an irrigation sluice	Do. do.	295	2 }
Padur Tank ...	Raising and repairing the bund, planting grass, repairing the two irrigation sluices, repairing and converting the calingulah into a weir.	Do. do.	532	51 I.

2. These sanctions are registered as shown above.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government

No. 351. Read the following letter from R. K. WILLIAMS, Esq., Examiner of Guaranteed Railway and Irrigation Accounts, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Madras, 19th May 1876, No. 604 I. :—

ADVERTING to the Orders of Government, No. 481, dated the 22nd February, and No. 836, dated the 31st March, I have the honor to inquire whether I am right in supposing that the establishment charges of the Madras Irrigation and Canal Company for the current official year should, until further orders, be admitted in accordance with the lists given in the first-named order as modified by the reduction of Rupees 23,112 mentioned in the last-named order.

No. 352. ORDER THEREON, 20th June 1876, No. 1,540.

IRRIGATION, No. 23-B.
Establishment.

THE Examiner of Railway Accounts will be informed that he is right in his view as to the extent to which establishment charges of the Madras Irrigation and Canal Company may be admitted pending further orders, and subject to the instructions conveyed in Proceedings, Madras Government, No. 1,296, of the 23rd May 1876.

2. In connection with the latter order, the Examiner of Railway Accounts will be instructed to report what subsidiary arrangements will be necessary for carrying out the orders of the Secretary of State.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following letters :—

No. 353. From Captain L. CONWAY-GORDON, R.E., Examiner of Public Works Accounts, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Fort St. George, 28th April 1876, No. 35 W.

I HAVE the honor to inquire what is the amount of the estimate sanctioned in G.O., No. 853A, of 31st March 1876. I should also be glad to know how the charge is to be classified, and to what work or system of works it is to be debited.

No. 353-A. From Major J. BEATTY, R.E., District Engineer, Godavery, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation and Joint Secretary to Government, Public Works Department, dated Dowlaishweram, 19th May 1876, No. 444.

WITH reference to your memorandum, No. 779, of the 6th instant, I have the honor to forward herewith a fresh estimate of tools required for Extraordinary Works in the Eastern Delta, Godavery, sanctioned in G.O., No. 853A, of 31st March 1876, in lieu of the one submitted with my letter, No. 3,656, of the 15th idem, with the heads of account to which the estimate is to be debited, shown on the face of the estimate.

2. The omission of the above information in the original estimate was an oversight; but it was stated in the covering letter that the cost of the estimate was proposed to be charged to the head "Tools and Plant," "Extraordinary."

N 354. ORDER THEREON, 20th June 1876, No. 1,541.

IRRIGATION, No. 23-BB.
Account.

THE Examiner is informed that the amount of the estimate in question is Rupees 577-8-0. Appended is a note of its classification, &c.

2. The sanction has been registered as Irrigation No. 52 I. of 1876-77.

(Signed) G. W. WALKER, Major-General, R.E.,

Secretary to Government.

Head of Service	... ...	Irrigation.
Fund ...	... ...	Capital, Extraordinary.
Class ...	... ...	III, Tools and Plant.
Main-head	... ...	12, Miscellaneous.
Sub-head	... ...	Nil.

Estimate of Tools required for Extraordinary Works in No. 1 *or Eastern Delta Division, Godavery District.*

Description of Tools.	No.	Rate.	Value.	Remarks.
Extraordinary.		RS. A. P.	RS. A. P.	
Baskets, sheet iron ...	500	1 2 0	562 8 0	Already ordered to be made up in the shop from the Budget provision.
Knives, large, for cutting bushes.	10	1 8 0	15 0 0	Already made up.
Total ...	...	...	577 8 0	

DOWLAISHWERAM,

May 1876.

(Signed) J. BEATTY, Major, R.E.,

District Engineer, Godavery.

No. 472. Read the following letter from Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Ootacamund, 14th June 1876, No. 23 :—

Five statements of expenditure for July to November 1875.

* No. 45, of 15th November 1875.
,, 49, of 4th December ,,
,, 7, of 28th February 1876.
,, 13, of 27th March ,,

In continuation of my letters noted in the margin,* I have the honor to forward, herewith, revised statements of expenditure on account of the operations of the Madras Irrigation and Canal Company for July to November 1875, in comparison with the Budget Allotment, and to request that the same may be substituted for those already sent and printed with the following G.Os. :—

No. 3,295, dated 18th November 1875.
,, 3,486, ,, 9th December ,,
,, 598, ,, 6th March 1876.
,, 814, ,, 30th March ,,

Revised Statement of Expenditure on account of the operations of the Madras Irrigation and Canal Company during the Month of July 1875.

Description of Charges.	Budget Allotment.	Expenditure. Up to the end of last Month.	In this Month (July 1875.)	Total.	Remainder of Allotment.
From State Expenditure.	RS.	RS.	RS.	RS.	RS.
Establishment of the Chief Engineer for Irrigation for the control of the operations of the Madras Irrigation and Canal Company	6,508	1,428	439	1,867	4,641
Purchase money of land ... Kurnool ...	3,000	29	38	67	2,933
Purchase money of land ... Cuddapah ...	1,500	...	...	...	1,500
Total ...	11,008	1,457	477	1,934	9,074
From Loan Capital.					
Establishment and Office Contingencies	59,820	838	227	1,065	54,708
Construction (Original Works)		2,448	684	3,132	
Plant and Stores		722	193	915	
Total ...	59,820	4,008	1,104	5,112	54,708
Revenue Account.					
Proportion of share or charges for General Management, including Office Contingencies	45,728	9,595	3,239	12,834	32,894
Conservancy Staff do.	87,200	20,827	6,337	27,164	60,036
Maintenance and Repairs	67,650	28,165	12,998	41,163	26,487
Total ...	2,00,578	58,587	22,574	81,161	1,10,417
Grand Total ...	2,71,406	64,052	24,155	88,207	1,83,199

Revised Statement of Expenditure on account of the operations of the Madras Irrigation and Canal Company during the Month of August 1875.

Description of Charges.	Budget Allotment.	Expenditure: Up to the end of last Month.	Expenditure: In this Month (Aug 1875.)	Expenditure: Total.	Remainder of Allotment.
From State Expenditure.	RS.	RS.	RS.	RS.	RS.
Establishment of the Chief Engineer for Irrigation for the control of the operations of the Madras Irrigation and Canal Company	6,508	1,867	440	2,307	4,201
Purchase money of land ... Kurnool ...	3,000	67	44	111	2,889
Purchase money of land ... Cuddapah ...	1,500	...	...	...	1,500
Total ...	11,008	1,934	484	2,418	8,590
From Loan Capital.					
Establishment and Office Contingencies	59,820	1,065	387	1,452	52,594
Construction (Original Works)		3,132	1,156	4,288	
Plant and Stores		915	571	1,486	
Total ...	59,820	5,112	2,114	7,226	52,594
Revenue Account.					
Proportion of share or charges for General Management, including Office Contingencies	45,728	12,834	1,446	14,280	31,448
Conservancy Staff do. Stationery	87,200	27,164	5,846	33,010	54,190
Maintenance and Repairs	67,650	41,163	3,462	44,625	23,025
Total ...	2,00,578	81,161	10,754	91,915	1,08,663
Grand Total ...	2,71,406	88,207	13,352	1,01,559	1,69,847

Revised Statement of Expenditure on account of the operations of the Madras Irrigation and Canal Company during the Month of September 1875.

Description of Charges.	Budget Allotment.	Expenditure: Up to the end of last Month.	Expenditure: In this Month (Sept.)	Expenditure: Total.	Remainder of Allotment.
From State Expenditure.	RS.	RS.	RS.	RS.	RS.
Establishment of the Chief Engineer for Irrigation for the control of the operations of the Madras Irrigation and Canal Company	6,508	2,307	440	2,747	3,761
Purchase money of land ... Kurnool ...	3,000	111	...	111	2,889
Purchase money of land ... Cuddapah ...	1,500	...	...	...	1,500
Total ...	11,008	2,418	440	2,858	8,150
From Loan Capital.					
Establishment and Office Contingencies	59,820	1,452	305	1,757	51,323
Construction (Original Works)		4,288	931	5,219	
Plant and Stores		1,486	35	1,521	
Total ...	59,820	7,226	1,271	8,497	51,323
Revenue Account.					
Proportion of share or charges for General Management, including Office Contingencies	45,728	14,280	1,849	16,129	29,599
Conservancy Staff do. Stationery	87,200	33,010	6,276	39,286	47,914
Maintenance and Repairs	67,650	44,625	3,440	48,065	19,585
Total ...	2,00,578	91,915	11,565	1,03,480	97,098
Grand Total ...	2,71,406	1,01,559	13,276	1,14,835	1,56,571

Revised Statement of Expenditure on account of the operations of the Madras Irrigation and Canal Company during the Month of October 1875.

Description of Charges.	Budget Allotment.	Expenditure			Remainder of Allotment.
		Up to the end of last Month.	In this Month (October.)	Total.	
From State Expenditure.	RS.	RS.	RS.	RS.	RS.
Establishment of the Chief Engineer for Irrigation for the control of the operations of the Madras Irrigation and Canal Company	6,508	2,747	432	3,179	3,329
Purchase money of land ... Kurnool ...	3,000	111	20	131	2,869
Purchase money of land ... Cuddapah ...	1,500	...	...	...	1,500
Total ...	11,008	2,858	452	3,310	7,698
From Loan Capital.					
Establishment and Office Contingencies	59,820	1,757	478	2,235	49,315
Construction (Original Works)		5,219	1,432	6,651	
Plant and Stores		1,521	98	1,619	
Total ...	59,820	8,497	2,008	10,505	49,315
Revenue Account.					
Proportion of share or charges for General Management, including Office Contingencies...	45,728	16,129	3,107	19,236	26,492
Conservancy Staff do. Stationery... ...	87,200	39,286	5,779	45,065	42,135
Maintenance and Repairs	67,650	48,065	2,683	50,748	16,902
Total ...	2,00,578	1,03,480	11,569	1,15,049	85,529
Grand Total ...	2,71,406	1,14,835	14,029	1,28,864	1,42,542

Revised Statement of Expenditure on account of the operations of the Madras Irrigation and Canal Company during the Month of November 1875.

Description of Charges.	Budget Allotment.	Expenditure			Remainder of Allotment.
		Up to the end of last Month.	In this Month (Nov. 1875.)	Total.	
From State Expenditure.	RS.	RS.	RS.	RS.	RS.
Establishment of the Chief Engineer for Irrigation for the control of the operations of the Madras Irrigation and Canal Company	6,508	3,179	478	3,657	2,851
Purchase money of land ... Kurnool ...	*1,000	131	...	131	869
Purchase money of land ... Cuddapah ...	*500	...	...	...	500
Total ...	8,008	3,310	478	3,788	4,220
From Loan Capital.					
Establishment and Office Contingencies	59,820	2,235	381	2,616	47,663
Construction (Original Works)		6,651	1,142	7,793	
Plant and Stores		1,619	129	1,748	
Total ...	59,820	10,505	1,652	12,157	47,663
Revenue Account.					
Proportion of share or charges for General Management, including Office Contingencies...	45,728	19,236	7,243	26,479	19,249
Conservancy Staff do. Stationery... ...	87,200	45,065	6,165	51,230	35,970
Maintenance and Repairs	67,650	50,748	1,882	52,630	15,020
Total ...	2,00,578	1,15,049	15,290	1,30,339	70,239
Grand Total ...	2,68,406	1,28,864	17,420	1,46,284	1,22,122

* *Vide* G.O., No. 3,277, dated 12th November 1875.

OOTACAMUND,
14*th June* 1876.

(Signed) A. DEC. SCOTT, Major, R.E.,
Deputy Chief Engineer for Irrigation,
for *Chief Engineer for Irrigation.*

No. 473. ORDER THEREON, 23rd June 1876, No. 1,574.

IRRIGATION, No. 24 & 25.
Account.

RECORDED and communicated to the officers concerned.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 474. Read the following letter from Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Ootacamund, 14th June 1876, No. 24 :—

Three Statements of Expenditure for December 1875, January and February 1876.

IN continuation of my letter, No. 13, of 27th March 1876, I have the honor to forward herewith the Statements of Expenditure on account of the Operations of the Madras Irrigation and Canal Company for December 1875, January and February 1876, in comparison with the Budget allotment.

Statement of Expenditure on account of the Operations of the Madras Irrigation and Canal Company during the Month of December 1875.

Description of Charges.	Budget Allotment.	Expenditure: Up to the end of last Month.	Expenditure: In this Month, Dec. 1875.	Expenditure: Total.	Remainder of Allotment.
	RS.	RS.	RS.	RS.	RS.
From State Expenditure.					
Establishment of the Chief Engineer for Irrigation for the control of the Operations of the Madras Irrigation and Canal Company	6,508	3,657	486	4,143	2,365
Purchase money of land ... Kurnool	1,000	131	3	134	866
Purchase money of land ... Cuddapah ...	500	...	...	...	500
Total ...	8,008	3,788	489	4,277	3,731
From Loan Capital.					
Establishment and Office Contingencies	59,820 (for the three heads)	2,616	517	3,133	45,597 (for the three heads)
Construction (Original Works)		7,793	1,549	9,342	
Plant and Stores		1,748	...	1,748	
Total ...	59,820	12,157	2,066	14,223	45,597
Revenue Account.					
Proportion of share or charges for General Management, including Office Contingencies	45,728	26,479	3,008	29,487	16,241
Conservancy Staff do. Stationery	87,200	51,230	5,999	57,229	29,971
Maintenance and Repairs	67,650	52,630	2,850	55,480	12,170
Total ...	2,00,578	1,30,339	11,857	1,42,196	58,383
Grand Total ...	2,68,406	1,46,284	14,412	1,60,696	1,07,710

Statement of Expenditure on account of the Operations of the Madras Irrigation and Canal Company during the Month of January 1876.

Description of Charges.	Budget Allotment.	Expenditure: Up to the end of last Month.	Expenditure: In this Month, Jan. 1876.	Expenditure: Total.	Remainder of Allotment.
From State Expenditure.	RS.	RS.	RS.	RS.	RS.
Establishment of the Chief Engineer for Irrigation for the control of the Operations of the Madras Irrigation and Canal Company	6,508	4,143	402	4,545	1,963
Purchase money of land ... Kurnool	1,000	134	6	140	860
Purchase money of land ... Cuddapah ...	500	...	19	19	481
Total ...	8,008	4,277	427	4,704	3,304
From Loan Capital.					
Establishment and Office Contingencies	59,820 (for the three items)	3,133	423	3,556	43,772 (for the three items)
Construction (Original Works)		9,342	1,270	10,612	
Plant and Stores		1,748	132	1,880	
Total ...	59,820	14,223	1,825	16,048	43,772
Revenue Account.					
Proportion of share or charges for General Management, including Office Contingencies	45,728	29,487	3,995	33,482	12,246
Conservancy Staff do. Stationery	87,200	57,229	6,099	63,328	23,872
Maintenance and Repairs	67,650	55,480	1,242	56,722	10,928
Total ...	2,00,578	1,42,196	11,336	1,53,532	47,046
Grand Total ...	2,68,406	1,60,696	13,588	1,74,284	94,122

Statement of Expenditure on account of the Operations of the Madras Irrigation and Canal Company during the Month of February 1876.

Description of Charges.	Budget Allotment.	Expenditure: Up to the end of last Month.	Expenditure: In this Month, Feb. 1876.	Expenditure: Total.	Remainder of Allotment.
From State Expenditure.	RS.	RS.	RS.	RS.	RS.
Establishment of the Chief Engineer for Irrigation for the control of the Operations of the Madras Irrigation and Canal Company	6,508	4,545	431	4,976	1,532
Purchase money of land ... Kurnool	1,000	140	...	140	860
Purchase money of land ... Cuddapah ...	500	19	64	83	417
Total ...	8,008	4,704	495	5,199	2,809
From Loan Capital.					
Establishment and Office Contingencies	59,820 (for the three items)	3,556	1,999	5,555	38,394 (for the three items)
Construction (Original Works)		10,612	3,354	13,966	
Plant and Stores		1,880	25	1,905	
Total ...	59,820	16,048	5,378	21,426	38,394
Revenue Account.					
Proportion of share or charges for General Management, including Office Contingencies	45,728	33,482	3,961	37,443	8,285
Conservancy Staff do. Stationery	87,200	63,328	4,671	67,999	19,201
Maintenance and Repairs	67,650	56,722	1,999	58,721	8,929
Total ...	2,00,578	1,53,532	10,631	1,64,163	36,415
Grand Total ...	2,68,406	1,74,284	16,504	1,90,788	77,618

OOTACAMUND,
14*th June* 1876.

(Signed) A. DEC. SCOTT, Major, R.E.,
Deputy Chief Engineer for Irrigation,
for *Chief Engineer for Irrigation.*

No. 475. ORDER THEREON, 23rd June 1876, No. 1,575.

IRRIGATION, No. 26.
Account.

ORDERED to be recorded.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following papers :—

No. 492. From Major J. BEATTY, R.E., District Engineer, Godavery, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Dowlaishweram, 30th May 1876, No. 570.

WITH reference to paragraph 5 of G.O., No. 698, of the 17th March 1876, I have the honor to forward, herewith, an estimate of the cost of the Survey Establishment required to carry out the investigations in connection with the Polaveram Island, and to inform you that the work has already been put in hand as directed.

No. 74 W.

No. 492-A. *Note by the Chief Engineer for Irrigation.*

THE estimate for surveys and levels, in connection with the Polaveram Island embankments, should have been supported by a memorandum of the quantity of work to be done. Without such details it is clear that the District Engineer could not form an opinion on the correctness of the estimate.

OOTACAMUND, (Signed) JOHN MULLINS, Lt.-Col., R.E.,
15*th June* 1876. *Chief Engineer for Irrigation.*

To the Secretary to Government, Public Works Department.

No. 493. ORDER THEREON, 23rd June 1876, No. 1,584.

IRRIGATION, No. 27 & 28.
Establishment.

(a) *Heads of Service.*—Irrigation.
Fund.—Ordinary, Agricultural.
Class.—Establishment.
Main-head.—Nil.
Sub-head.—Nil.
Name of Work.—Survey Establishment required in connection with the Polaveram Island embankments.
Amount.—Rupees 560.
To be carried out by the Public Works Department.

THE estimate, amounting to Rs. 560, submitted by the District Engineer, Godavery, for Survey Establishment required to carry out the investigations ordered in G.O., No. 698, dated 17th March 1876, paragraph 5, in connection with the Polaveram Island embankments, is sanctioned. The charge will be met from the provision for Survey Establishment in the Budget of 1876-77, which will be distributed under heads of account in the final issue of the Budget.

2. The attention of the District Engineer will be called to the remarks of the Chief Engineer for Irrigation, and he will take care that in transmitting the revised estimate,* particulars of the survey work done are given.

* For the flood banks.

3. This sanction has been registered as Irrigation No. 54 I. of 1876-77.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following papers:—

No. 498. From Colonel C. H. DICKENS, R.A., Secretary to the Government of India, Public Works Department, (Account—Irrigation,) to Major-General G. W. WALKER, R.E., Secretary to the Government of Madras, Public Works Department, (Irrigation Branch,) dated Simla, 3rd June 1876, No. 225 A—I.

THE Accountant-General, Public Works Department, has laid before the Government of India the Statement of Objectionable Items in the accounts of Irrigation Works in Madras for November 1875, from which it would appear that an excess outlay of Rupees 16,857 over estimate had, up to that period, been incurred on the Pelandorai Project.

2. The attention of the Government of Madras was directed to the excess expenditure over estimate for this work in the orders* of the Government of India on the Madras Irrigation Budget-estimate for 1875-76, in which it was remarked that "the probable excess is more than 5 per cent. over the estimated cost of Rupees 2,00,555, and the Government of India must, therefore, ask of the Government of Madras to take such steps as will ensure the submission of the revised estimate for the project with the least possible delay. Meanwhile, an immediate report should be submitted of the probable amount of the revised estimate for the work." In reply to this inquiry, it was said in the Proceedings† of the Government of Madras, forwarded with letter, No. 1,228, dated 1st May 1875, that "it is understood that the revised estimate for the Pelandorai Anicut Project has just been received by the Chief Engineer from the District Engineer, South Arcot, and its submission should be expedited." But the estimate in question has not as yet been received, and I am, therefore, to ask that the Government of Madras will cause steps to be taken for the prompt submission of the same to the Government of India, and that a report may be submitted, as soon as possible, of the probable amount of the revised estimate for the work. If the work has been finished, or nearly so, a Completion Bill instead of a revised estimate should be submitted for the orders of the Government of India; the excess outlay being beyond the competency of the Government of Madras to sanction.

* Paragraph 10, Clause III.

† No. 1,227, dated 1st May 1875, paragraph 5.

No. 75 W.

No. 498-A. *Note by the Chief Engineer for Irrigation.*

THE Pelandorai Anicut revised estimate was received in this Office, and it was found that it could not be submitted to Government without further information as

to items on which considerable excess had occurred; also that it was incomplete both as regards provision for works, and in respect of establishment, tools and plant, capitalised assessment of lands taken up, &c. The estimate was returned to the District Engineer with instructions on the 30th December last, and on the 1st February that officer reported that there had been found to be difficulties in settling contractors' accounts, and that as soon as these had been closed he would endeavour to carry out the instructions given for the revision of the estimate, though he did not hope to be able to do all that was wanted. The cause of delay since that time is not known in this Office.

No. 205.

2. The amount of the estimate as submitted last year was Rupees 2,52,435.

3. The unsatisfactory management of this project was brought to notice in the Notes of an inspection made in 1874, and is referred to in paragraph 8 of G.O., No. 3,143, of the 5th November 1874. One result of this mismanagement has been undoubtedly great difficulty in ascertaining what particular works have cost, and in giving the explanations of causes of excess which must accompany the final estimate.

OOTACAMUND, 17*th June* 1876.

(Signed) J. MULLINS, Lieut.-Colonel, R.E.,
Chief Engineer for Irrigation.

No. 499. ORDER THEREON, 24th June 1876, No. 1,586.

IRRIGATION, No. 29.

THE District Engineer, South Arcot, will be instructed to report at once when the Pelandorai Anicut revised estimate will be ready, and what has caused the delay in its submission.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 500. Read the following letter from Colonel A. S. MOBERLY, R.E., District Engineer, Cuddapah, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Camp at Boothulnootty-gudda, 17th June 1876, No. 655 :—

WITH reference to G.O., No. 57, of 6th December 1875, I have the honor to inform you that the approximate estimate for putting into order the Chintacoonta tank in the Jamalamadugu taluq amounts to Rupees 50,000, and so, as directed, no further proceedings will be taken.

No. 501. ORDER THEREON, 24th June 1876, No. 1,587.

IRRIGATION, No. 30.
Account.

RECORDED, with reference to G.O., No. 57, dated 6th December 1875.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 504. Read the following :—

No. 191.

STATEMENT showing the Sums received and disbursed at this Presidency on account of the Madras Irrigation and Canal Company during the Month of April 1876.

—	Receipts.		Disbursements.	
	Capital Account.	Revenue Account.	Capital Account.	Revenue Account.
Bank of Madras.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Received from the Chief Engineer and Manager, Madras Irrigation and Canal Company	...	242 6 11	...	...
Collector of Kurnool.				
Tax for water supplied by the Irrigation and Canal Company realized in April 1876 ...	...	1,135 2 3	...	...
Amount received in do. on account of assessment of land made over to the Company ...	...	159 9 7	...	...
Amount of cheques paid on account of letter of credit issued by the Accountant-General	...	...	...	2,974 1 7
Collector of Cuddapah.				
Tax for water supplied by the Irrigation and Canal Company realized in April 1876 ...	...	1,490 0 2	...	...
Amount received in do. on account of assessment of land made over to the Company ...	...	...	...	...
Amount paid to the Village Kurnums upon the demands of their respective villages for the water supplied by the Madras Irrigation and Canal Company in the District of Cuddapah for Fusly 1284	...	...	...	514 8 1
Payments from the commencement, *viz.*, 1st October 1859 to 31st March 1876, on Capital Account...	...	...	93,58,307 0 5	...
Do. do. to do. on Revenue Account	...	...	...	7,06,068 1 10
Receipts from do. *viz.*, 1st May 1865 to do. on Capital Account	1,68,417 5 9	...	...	...
Do. do., *viz.*, May 1865 to do. on Revenue Account...	...	2,45,052 15 1	...	...
Grand Total of Receipts and Disbursements up to 30th April 1876...	1,68,417 5 9	2,48,080 2 0	93,58,307 0 5	7,09,556 11 6

FORT ST. GEORGE, (Signed) R. W. LODWICK,
21st *June* 1876. *Accountant-General.*

Forwarded to the Secretary to Government, Public Works Department, Fort St. George.

Vide letter from Financial Secretary to the Government of India, dated 24th June 1869, No. 1,375.

No. 505. ORDER THEREON, 26th June 1876, No. 1,589.

IRRIGATION, No. 31.
Account.

ORDERED that the foregoing statement be communicated to the Chief Engineer for Irrigation, and that the following letter be despatched :—

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 506. From the Secretary to the Government of Fort St. George, Public Works Department, to the Under Secretary of State for India, dated 26th June 1876, No. 1,590.

IRRIGATION, No. 32.

Account.

	RS.	A.	P.
Capital	93,58,307	0	5
Revenue	7,09,556	11	6
	1,00,67,863	11	11

SIR,—I am directed by the Governor in Council to forward the accompanying statement, which has been furnished by the Accountant-General, showing the sums received and disbursed on account of the Madras Irrigation and Canal Company for the month of April 1876. The aggregate amount expended up to 30th April 1876 was Rupees 1,00,67,863-11-11.

Read the following :—

No. 64 W.

No. 516. *Note by the Chief Engineer for Irrigation.*

THE District Engineer, Madura, forwards, with his letter marginally noted, an estimate in connection with the Athekaricolum tank of Vadakary, situated in the Pereacolum Taluq, Dindigul Range.

No. 4,783, dated 26th March 1876.

2. The nature of the work proposed for execution and the heads of account to which it is chargeable are as follow :—

	RS.
Raising and repairing the bund, calingulahs and sluice, also repairing and improving the supply channel. Ordinary Agricultural—Repairs	1,750
Constructing a new masonry weir and improving the existing calingulahs. Ordinary Agricultural—Original Works ...	515
Total ...	2,265

3. The following particulars of this tank are recorded :—

Ayacut area...	Acres	124
Assessment	Rupees	711
Average revenue	,,	702
Highest do.	,,	711
Expenditure during the previous four years		*Nil.*

The area of the catchment basin is 4 square miles; the maximum flood supply is calculated at 1,512 cubic feet per second, for discharging which, as surplus, there are two calingulahs, one at the eastern end of the bund and the other in the channel. It is proposed to remove the dam stones from these calingulahs and to raise their body walls to F.T.L., and also to construct a new masonry weir 66 feet in length, which will make a total length of 109 feet available for the surplus discharge.

The estimate is recommended for sanction, it being noted that the high rate of Anna 1 and Pice 3 per cubic yard for earthwork is explained to be owing to the demand for labor on coffee estates in the neighbourhood, and that the repairs have already been carried on on emergency.

30*th May* 1876. (Signed) A. DEC. SCOTT, Major, R.E.,
Dy. Chief Engineer for Irrigation,
for *Chief Engineer for Irrigation.*

To the Secretary to Government, Public Works Department.

No. 517. ORDER THEREON, 26th June 1876, No. 1,596.

IRRIGATION, No. 33.
Account.

THE following estimate from the Dindigul Range, forwarded by the District Engineer, Madura, is sanctioned :—

ATHEKARICOLUM TANK.

Irrigation.	RS.
1. Raising and repairing the bund, repairing the calingulahs and sluice, repairing and improving the supply channel. Ordinary Agricultural—Repairs	1,750
2. Constructing a new masonry weir and improving the existing calingulahs. Ordinary Agricultural—Original Works ...	515
Total ...	2,265

2. This sanction has been registered as No. 55 I. of 1876-77.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 533. Read the following endorsement of the Chief Engineer for Irrigation, dated Ootacamund, 19th June 1876, No. 77 W.

Read the following papers :—

From Major G. V. LAW, District Engineer, Trichinopoly, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Trichinopoly, 16th January 1875, No. 527.

I HAVE the honor to report on the damages sustained by the Vanavanellur tank, Udaiyarpoliam taluq, which tank was last repaired in December 1874 at a cost of Rupees 330.

2. The Sub-Engineer in charge of the Range reports that, on the 13th ultimo, the tank filled in about two hours and reached the top of the bank. The ryots then cut the bank at the western end in spite of which the calingulah at the north-eastern end was carried away bodily.

3. He reports that the tank receives the drainage of nearly fifty square miles, besides a supply from a large jungle stream.

4. He further states that the tank has been regularly breaching for the last ten years, and that the revenue it yields is only Rupees 414-3-0 per annum.

5. In conclusion, I have the honor to request to be informed what steps I should take in the matter, if I should find, on further inquiry, that it would not be advisable to rebuild the calingulah and undertake the repairs.

No. 533-A. Memorandum to the District Engineer, Trichinopoly, dated 20th January 1875, No. 83-A.

No. 533-B. From Major J. VERTUE, R.E., District Engineer, Trichinopoly, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated 9th June 1876, No. 241.

HAVING inspected the Vanavanellur tank and had some cross sections taken, I am able to reply to your Memorandum, No. 83-A, of 20th January 1875.

2. The question, as you may remember, is, is the tank to be retained as a reservoir, or is the bed to be given up for dry cultivation?

3. The answer is that, pending a decision as to the partial restoration of the great Ponnary tank, the surplus of which the tank in question will receive, all hope of making use of the tank as a reservoir need not be abandoned, but that not a single rupee should be at present spent on the tank (which is a very poor one) for the following reasons.

4. The tank when full averages $2\frac{1}{4}$ feet in depth, contains 360,000 cubic yards of water, and receives the drainage of fifty square miles. The length of its bund is 1,473 yards and of its calingulah (breached, in fact ruined) 18 feet!!! With a fall of 2 inches over the drainage basin (fifty square miles), and allowing twenty-four hours for the discharge of the same, with a head of 18 inches, a calingulah about 500 feet long would be required. Two inches over so large an area as fifty square miles may be considered excessive, but, on the other hand, twenty-four hours in the Udaiyarpoliam taluq is a long time to allow for discharge, as *there* the streams come down and subside with extraordinary rapidity, owing to causes on which I need not enter. However, whether or no the assumption be extravagant, it is evident that the tank should be provided with a calingulah many times the size of its present one.

5. This is however not all. The soil is extremely bad for making an embankment, and there is no stone revetment, nor means of providing one, except at an enormous expense. The tank was well and thoroughly repaired in 1874-75 at a cost of 330 Rupees; to look at it, you would think it had not been repaired for many years. Under the fore-mentioned circumstances, it can scarcely be a matter for surprise that the tank has only been repaired to be breached. The expenditure during the last ten years has been Rupees 634-0-5.

6. With regard to the Ponnary tank aforementioned, I am about to institute an investigation into the propriety of partially restoring it. It would intercept the large jungle stream which now breaches the Vanavanellur tank, also the Thengal Oday, a still larger stream of *good* water, which now falls into the Vadavor, and is in no other way utilised. It has an enormous bund four or five miles long, and two very large sluices, one of which I have seen. The sluice is of laterite, cased throughout with well-dressed stone with a very fine cutstone floor, and is quite repairable. The land commanded by the tank is very good and very favorable for irrigation, and altogether if the restoration can be affected at a reasonable cost, I think the project likely to prove a most important one.

7. The tank is said to have been constructed 80 or 100 years ago by a private individual called Ponna; but, looking to the enormous magnitude of the work, I think it far more probable that it was carried out by Kings of the Cholah Dynasty, by whom was built the splendid Pagoda of Gungakondasholapuram (two miles from the tank and commanded by it), and who are said to have made it their capital. If so, there must at one time have been a large population at this place, and it is utterly inconceivable to me how they can have obtained a supply of water if this tank did not exist.

8. In conclusion then I cannot recommend *any* expenditure on the tank. I have intimated the same to the Collector, sending him at the same time a copy of this letter.

SUBMITTED for the information of Government.

The undersigned has been unable to find on the atlas sheet any of the names referred to in the District Engineer's later letter.

2. A small tank receiving the drainage of fifty square miles, holding but 9·72 millions of cubic feet, or sufficient for 80 to 90 acres of irrigation at most, would, under any circumstances, be not worth any large outlay. In this case, moreover, the soil is reported to be bad, and there is no stone available at hand for protecting the bund. The small escape (18 feet) formerly existing has been swept away, and the tank has been repeatedly breached, an occurrence which must necessarily take place every time there may be a considerable fall of rain. To render it safe a maximum flood discharge of about 6,500 cubic feet a second would have to be provided for and a surplus weir 685 feet long would be required with M.W.L. 2 feet above F.T.L. The cost of such a weir would be about 7,000 Rupees, even if a convenient site or sites affording the space necessary be available, and probably other items of work would amount to nearly 1,000 Rupees additional, so that altogether an outlay of nearly twenty years' average revenue would be necessary. Consequently, the reformation of the tank appears to be out of the question.

$$350\sqrt[4]{(50)^3}$$

3. On the other hand, it is reported that the cost of repairs during the last ten years has been Rupees 634; and, as the revenue of the same period has been upwards of 4,000 Rupees, the tank has not been unprofitable. The undersigned considers therefore that, pending a settlement of the question of the restoration of the Ponnary, it may be desirable to maintain the Vanavanellur tank temporarily, and the best plan in that case will probably be to make a long temporary escape by removing the bund at the two ends so as to afford a waterway of 700 to 800 feet over the natural soil, which may be turfed for a width of three or four yards to prevent scour. The ends of the bund if revetted with turf (not merely turfed) with a foundation of a couple of feet would be fairly secure, and the work done in this way might be expected to last for five or six years. As much of the soil of the removed bund as may be required may be placed on the bund to be retained.

(Signed) JOHN MULLINS, Lt.-Col., R.E.,
Chief Engineer for Irrigation.

No. 534. ORDER THEREON, 26th June 1876, No. 1,605.

IRRIGATION, No. 34.

THE District Engineer, Trichinopoly, will be authorized to treat the Vanavanellur tank as an exceptional case in the manner pointed out by the Chief Engineer for Irrigation, should he find it feasible to carry out the arrangements suggested, and to sanction the estimate should it not exceed Rupees 1,200. The amount which would be necessary to render this tank safe and efficient would be far too large to admit of its retention permanently, and if the Ponnary tank restoration be negatived, the Vanavanellur tank can be retained only so long as there is a probability of the revenue exceeding the cost of maintenance, unless the Collector can adduce special reason for its retention.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following :—

No. 78 W.

No. 557. *Note by the Chief Engineer for Irrigation.*

In the note forwarding the estimate for the repair and improvement of the Acherewauk tank in the Chingleput District sanctioned in G.O., No. 1,175, dated the 11th ultimo, the attention of the Government was through inadvertence not drawn to the fact that the cost of reconstructing one weir, 43 feet in length, was debitable against the South Indian Railway, which had cut off one of the weirs of the tank and rendered it useless.

2. The debit of the charge as noted above had, however, been proposed by the Company's officers, and their proposal to reconstruct the weir had been communicated to the undersigned by the Consulting Engineer, whose letter, together with the communication in reply from this office, is now enclosed.

3. It will be observed that in the latter the reconstruction of the work by the Company was considered unobjectionable, provided they were prepared to meet possible demands due to the change in the position of the surplus discharge from the tank, and it may be desirable to notice that in all cases in which the railway line interferes with works of irrigation and renders changes in their arrangement necessary, these should be carried out at the cost of the Railway Company, who should as far as possible secure to the work the hydraulic conditions, such as full tank level, maximum water level, and capacity for discharge of flood water which obtained before the construction of the line.

4. The reply from this office was based on the supposition that there was only one weir to the tank. There being two, the additional length given to the one to be reconstructed by the railway will probably satisfy their obligations.

Ootacamund, (Signed) JOHN MULLINS, Lt.-Col., R.E.,
19*th June* 1876. *Chief Engineer for Irrigation.*

To the Secretary to Government, Public Works Department.

No. 558. Order thereon, 26th June 1876, No. 1,618.

IRRIGATION, No. 34-A.
Account.

The conclusions of the Chief Engineer for Irrigation as to the obligations of the Railway Company are concurred in by the Government; and therefore in all cases in which a railway line interferes with works of irrigation, and renders changes in their arrangements necessary, these should be carried out at the cost of the Railway Company, who must secure to the work the hydraulic conditions, such as full tank level, maximum water level, and capacity for discharge of flood water which obtained before the construction of the line, as well as the safety of the line itself from any injury by the tank water.

2. It is understood that the similar work referred to is being carried out at the expense of the South Indian Railway Company.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

Read the following papers :—

No. 559. Endorsement of the Chief Engineer for Irrigation, dated 20th October 1875, No. 1,229.

From R. SMITH, Esq., Officiating Superintending Engineer, Nellore, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation and Joint Secretary to Government, Fort St. George, dated Nellore, 19th October 1875, No. 58.

I HAVE the honor to forward the separate notes referred to in paragraph 13 of the joint report on the diversion of the Perryaur submitted by Captain Pennycuick and myself on the 6th instant.

Submitted to Government with reference to G.O., No. 2281, of the 6th August last.

(Signed) J. MULLINS, Lieut.-Col., R.E.,
Chief Engineer for Irrigation.

No. 560. Endorsement of the Chief Engineer for Irrigation, dated Fort St. George, 5th January 1876, No. 14.

Note by Mr. R. Smith.

In the joint report* submitted by Captain Pennycuick and myself on the suggestions recently made for diverting water from the Perryaur for the irrigation of a portion of the Madura District, we promised to record our opinions separately regarding the substitution of a masonry dam for the silt embankment proposed for No. 4 site, and, in stating mine, I must not omit to mention that I was at one time in favor of having a masonry dam, and would have prepared a detailed estimate for one when maturing the scheme if my approximate calculations had not indicated that such a structure would be too costly to recommend, and I have to add that I am still of this opinion.

* Dated 6th October 1875.

2. To construct a masonry dam of the required height successfully it would, I consider, be necessary to arrange for proceeding simultaneously with the masonry throughout the entire length and breadth of the dam and for having the site perfectly dry before commencing building operations. The estimate for the dam must, therefore, include the cost of a temporary escape tunnel of the same water section as that allowed for discharging floods during the construction of the silt embankment proposed by me on the 15th April 1872. This subsidiary, but in my opinion indispensable, work would add considerably to the cost of the dam, and I am inclined to the belief that an outlay of Rupees 19,20,000 would be required to close the valley with a wall of substantial masonry. In this calculation I have assumed that first-class rubble masonry would be used throughout the whole dam, and that the average cost of this masonry would be Rupees 8 per cubic yard.

3. The cost of construction would, no doubt, be reduced by using concrete freely, but whether it would be advisable to do so is extremely doubtful. The

risk attending the use of two distinct kinds of material and the difficulty of preventing leakage between them are questions deserving of consideration in disposing of the proposal.

4. With reference to allowing the discharge of the Perryaur to flow through temporary openings or vents in the dam, I must observe that very superior masonry would be necessary to stand the high velocity that would be generated during freshes in that river, and that the subsequent closing of these outlets with watertight joints would be so tedious and uncertain as to practically condemn the arrangement requiring them.

5. As considerable importance appears to be attached to the closing of the temporary escape, I think it desirable to state that I am convinced it could be securely and easily done without masonry or backing of any kind by dividing the head of the tunnel into bays of convenient size by iron frames, with grooves in them, for iron shutters. The latter would be lowered into their proper places in li in succession, and the closing would not be more difficult than is constan y experienced in working the shutters of some of our existing sluices.

NELLORE,
19*th October* 1875.

(Signed) R. SMITH,
Offg. Superintending Engineer.

Note by Captain J. Pennycuick, R.E.

I wish to add to the joint report submitted by Mr. Smith and myself a few remarks upon the mode proposed for passing the river under the dam during construction and upon some other matters connected with the project.

2. These remarks refer to points upon which we are not so entirely in agreement as on those referred to in the joint report, though there is not, I think, any great difference of opinion between us, and as I alone am responsible for the proposal, which is the main object of this separate note, we have thought it desirable that it should be made independently of the joint report. Mr. Smith will, however, add his own remarks, from which it will be seen how far we are in agreement.

3. The Chief Engineer, in paragraph 6 of his memorandum, No. 695, of April last, suggests further consideration of "Captain Pennycuick's expedient of raising such dams on a substructure of some sort," and it may be as well to recall the history of the proposals made with reference to this part of the project.

4. Up to my arrival in Madras in April 1870 no doubt had been expressed that a masonry culvert under the dam was the proper means to be used for this purpose; the substitution of a tunnel was first proposed by General Orr with a view of avoiding the difficulty, then supposed to be much greater than I now believe it to be, of constructing a masonry culvert at the Perryaur.

5. I subsequently proposed a culvert of Portland cement concrete as being easier and cheaper to construct than a tunnel, and easier, though not cheaper, than a masonry culvert; this proposal was objected to by Colonel Mullins, his objections being based on arguments which I do not think he would have used had he possessed the information which I had as to what had actually been done with this material,* still less if he could have foreseen what has since been done with it.

* Witness the remark that "it might or might not do to use a concrete containing only one-ninth of its bulk of cement."

6. I should not, however, now propose the use of this material, not because my belief in its value is in any way diminished, but because I think that the difficulties of executing the necessary work in stone masonry are less than they were formerly supposed to be, and do not outweigh the greater cheapness of the latter material.

7. The cost of the culvert for a dam 205 feet high was estimated by me at Rupees 2,70,000, as against about Rupees 7,00,000 which would be required for a tunnel at the same site, but the real cause of this great difference was not the substitution of a culvert for a tunnel or of Portland cement concrete for masonry (the former, indeed, being more expensive than the latter), but the reduction of waterway obtained by the mode in which I proposed to construct the dam, that is, by completing the flanks to nearly their full height before filling in the central portion. This allowed the valley to be closed to a greater height during the limited time available for this purpose than if the whole width had to be done at once, and so enabled us to use a smaller culvert.

8. I have never understood, and do not now understand, the reasons for which Colonel Mullins objected to this arrangement; in his note, No. 56, of 28th February 1871, he gives no such reasons, but simply says that "it had been decided" that the bund was to be thrown entirely across the river after the completion of the tunnel. I have no recollection of any such decision having been arrived at, and Colonel Mullins' note printed with O.G., No. 2466, of 28th July 1869, in the last part of paragraph 9, distinctly enjoins the course which I afterwards proposed.

Paras. 7 & 8.—The objection to forming the flanks of an earthen bund in a season prior to that in which the central portion would be formed is that the former earthwork would settle independently of the latter and thus render the mass less equally compact and homogeneous. Had an earthen bund formed by manual labor been considered a proper and safe arrangement, the narrowing of the central space by the prior formation of the bund on the flanks would have been unavoidable; but, as by the silting process it became practicable to execute the work much more rapidly, the less safe and satisfactory method was of course abandoned.

9. Not knowing what the objections to this course are, I cannot, of course, answer them, and this is perhaps of the less consequence inasmuch as the reduction of waterway practicable at the lower site is comparatively small. The area of the lake here is so much larger than at No. 3 site that a tunnel (or culvert) of only 1,064 square feet is required even if the whole width of the valley is to be closed at once, and I should not, under any circumstances, care to reduce this below 600 square feet. The cost of the tunnel is estimated by Mr. Smith at Rupees 5,63,000, and a culvert of the same area and running under the whole width of the dam would cost, if of masonry, about Rupees 5,20,000, and, if of Portland cement concrete, about Rupees 7,50,000.

10. By reducing the area of waterway to 600 square feet the cost of the culvert might be reduced to Rupees 3,00,000 for masonry and Rupees 4,20,000 for concrete, and a further reduction of about one-fourth of these sums might be made by reducing the length of the culvert as originally proposed by me, which has also been disallowed by Colonel Mullins for reasons with which I am not acquainted.

Para. 10.—The length of culvert or tunnel depends upon the thickness or width of the bund. The means of passing freshes have to be retained until the bund has been fully completed, and consequently the culvert or tunnel must be of a length not less than the width of the bund section where it may be placed. It was laid down in the instructions contained in Proceedings of the Madras Government, No. 1236, of the 12th May 1870, memorandum, paragraph 7, clause 1, that the tunnel faces were to be six feet clear of the slopes of the bund when of full section.

11. The cost of the tunnel would not be reduced in the same proportion by reducing the waterway, and one of 600 square feet of area would probably cost about Rupees 4,50,000.

12. For my own part I am still strongly in favor of the masonry culvert not so much on grounds of economy as of convenience in construction and of safety, for the tunnel will take longer to construct than the culvert and we have no security against interruption to the work, and danger to the embankment, from fissures in the rock through which it is made.

Para. 12.—Supposing the rock to be of a favorable description, and that at sites Nos. 2 and 3 appeared to be so, the tunnel would be preferable to a culvert, and, with the appliances now available for such work, its construction would be easy and rapid. It would occupy a much shorter time than could have been deemed probable five years ago. Neither during the formation of the bund nor after closure of the tunnel would fissures in the rock through which it had been driven be of any greater or less consequence than they would be were the tunnel left unconstructed. If the fissures be extensive and by their direction dangerous, a bund cannot prudently be abutted on hills composed of such rock.

13. I attach but little importance to the difficulty of closing the tunnel, and this difficulty, if it exists, would apply almost as much to a culvert.* I do not think Colonel Mullins' plan would be effective, as I should question the probability of the silt deposited in water, with no means of draining off the latter, keeping the mouth of the tunnel water-tight while the masonry in rear was being built up, but I have long ago matured other arrangements, which, I have little doubt, would be perfectly efficient.

* Not quite as much as the division of the culvert into smaller spans would afford greater facilities for closing.

Para. 13.—The silt to be deposited in front of the upper end of the tunnel would make a closure more water-tight than probably any other possible arrangement. The silt itself would be absolutely impervious to water, and by its close contact with the uneven sides of the cutting leading to the tunnel, it would be the best material possible for preventing the passage of water along those faces. The thickness of silt may be increased to any desired extent within the limits of the length of the open cutting.

Memo. para. 7—5th Proceedings of Madras Government, No. 1236, 12th May 1870.

14. For reasons given in Mr. Smith's and my joint report, and upon which we are entirely agreed, it does not appear that any sub-structure, except a masonry culvert or a tunnel, is practicable save at a disproportionate cost, neither does it appear advisable to attempt to combine the temporary and the permanent escape.

15. I think however—and it is to this point that I specially invite attention—that it is worthwhile to consider whether the dam should not be of masonry instead of earth. I have little doubt that an earthen dam constructed by the silting process would be sound and safe, but it would be folly to deny that there is some element of risk in the matter. The chief danger in my view is that of percolation, not through the dam, but between it and the rock (the puddle trenches inserted in the seat of the dam would not, so far as I can see, be of the smallest use); and, although opinions may differ as to the extent of this danger, it seems unadvisable to incur it if it can be avoided at a reasonable expense.

Para. 15.—A masonry instead of a silted earthen dam is undoubtedly a feasible method of closing the Perryaur. A masonry dam would be as preferable to an earthen bund formed manually as a silted bund is believed to be preferable to a masonry dam. At the same cost silt, as being more water-tight than masonry or concrete, would be the better material, and as regards facility and rapidity of construction silting is decidedly superior. Masonry would have a much better chance of standing were unseasonable freshes of magnitude to occur in the first working season of the bund or dam formation, and with this solitary point in its favor the advantage is believed to end.

16. This truth is that we have all been somewhat too hasty in rejecting masonry as the material of the dam ; inquiries that I have lately made have convinced me that it should be adopted, and some months ago I wrote demi-officially to Colonel Mullins suggesting that the question should be considered. It is not at all necessary that the whole mass of the dam should be of solid masonry. Concrete divided into cells by means of proper longitudinal and, cross walls may be used to a great extent, and in point of fact, the use of this material is to some extent an actual advantage, as it is lighter than solid masonry, and the risk of crushing, which is the chief one with dams of great height, is diminished.*

* The thickness at bottom necessary to prevent crushing is enormously in excess of that necessary for statical stability; it is, in fact, notorious that no dam of any size has ever been overturned by statical pressure.

Para. 16.—The cellular system of construction is inapplicable as will be more full explained further on.

17. A dam some seventy feet high has lately been built in America almost entirely of concrete with a mere casing of masonry, the proportion of the latter being apparently less than half what I propose to allow.

Para. 17.—Here the faults of the cellular system are avoided.

18. Fortunately the position of the rock on both sides of the river at No. 4 site has been so accurately determined that an estimate of quantities can be made without difficulty.

19. At the risk of making this report too long, I will describe the section to be given to the dam and three methods of construction which have occurred to me.

20. The former is taken from a formula of Mr. Molesworth's given in one of the late numbers of the Roorkee papers as a modification of Professor Rankine's somewhat complicated one. It is $x = 7{\cdot}5 \sqrt{\frac{h^3}{P}}$ where x is the distance of the rear edge of the dam from the vertical line drawn through the front edge at the top, h the distance from the top, and P a constant depending on the nature of the material, in this case 21,600. Its use is limited by the minima $x = \frac{h}{2}$.

and $x = a + a\frac{h}{10}$ a being the top thickness. In the margin are shown the values of x thus obtained ; the front slope is a simple batter of one in ten. Figure 1 shows the section given by this formula.

	by formula—	$\frac{h}{2}$	$—\frac{h}{10}$
$h = 0$	0	0	10
10	1·6	5	11
20	4·6	10	12
30	8·4	15	13
40	12·9	20	
50	18·1	25	
60	23·8	30	
70	28·7	35	
80	36·5	40	
90	42·4	45	
100	51·0	50	
110	58·9		
120	67·0		
130	75·8		
140	84·5		
150	93·8		
160	103·3		

Para. 20. It is believed that this formula would give dimensions which would be safe.

21. The face and back of the dam to the extent shown in the sections will be of solid masonry, and longitudinal and cross walls of

Para. 21.—The objection to a combination of walls and concrete is that the settlement of the two materials being unequal spaces must be left,

the same material, six feet thick, will run along the length and breadth of the dam. The longitudinal wall will be forty feet from the face wall, and the cross walls will be eighteen feet apart up to the datum line, above which every other one will be omitted, making them forty-two feet apart, the cells formed by these walls being filled with concrete.

which may prove injurious. Captain Pennycuick's section would, were all the interior masonry walls left out, be unobjectionable so far as essential constructive requirements are concerned. A good many years ago the undersigned designed a dam for the Luckawully reservoir with an arrangement of walls and concrete not materially dissimilar to Captain Pennycuick's design, but the idea was abandoned on reading the opinions of French Engineers on the subject, the certainty of irregular settlements being indisputable.

22. The first method of construction suggested is to allow the water to pass over the dam during construction. At first, of course, the depth passing over would be great, perhaps as much as twenty feet during a great flood, but here the overfall would be small, and as the dam was raised its length would increase rapidly and the depth necessary to pass a given flood would be proportionately diminished.

23. Here we should have the advantage of being able to construct the whole work solidly and homogeneously without having to make connections between old and new work and without having to work in a confined space as must be the case in closing a tunnel or culvert, and it may be considered that this would outweigh the evil of allowing the water to pass over the work during construction ; the point is one on which there is considerable room for doubt.

Para. 23.—It would not do to run the risk of damage from allowing freshes to pass over the masonry dam while under construction.

24. If this plan be adopted, the course of procedure would be as follows :—The cross walls, eighteen feet apart and six feet broad, of the portions on the two flanks of the river will first be constructed up to about twenty feet above the river bed as shown in figure 3. Being clear of the ordinary stream, this portion of the work will be constructed with little interruption and no risk.

25. Advantage will be taken of the fall of the river, which always takes place in August and September, to encroach upon the bed by means of the temporary dams marked *aa* on figures 4 and 5, and so construct a few more cross walls in the shallower part of the bed ; we should, of course, only work from one bank at a time, and it is believed that all the lower part of the dam except a width of about 100 feet at the most might thus be constructed by the end of September of the first season.

26. As soon as the north-east monsoon was over, this gap would be closed by means of similar temporary dams, and the cross walls of the central portion would be constructed ; the

Paras. 24 to 27.—The remarks in these paragraphs show that Captain Pennycuick has not appreciated the importance of keeping the work as much as possible at one level so that unequal settlements may be reduced to a minimum.

work would then consist of a series of piers six feet thick with spaces of eighteen feet between them. It should be mentioned here that these piers are shown on the plan with straight edges, but they would, of course, be joggled where necessary to provide for the bonding in of the longitudinal walls.

27. By means of framed wooden shutters any one or more of these openings might be closed and the longitudinal walls and concrete filling put in to a certain height, the water in the mean time passing through the other openings. The head on the shutters would never be more than seven or eight feet except for a few hours during high floods, and the leakage could be easily disposed of by small pumps so as to allow the masonry to be solidly and carefully constructed. The number of vents to be closed at a time would depend mainly on the state of the stream, and probably five or six feet would be the amount of each successive step in the filling ; the cross walls would be kept about fifteen feet above the remainder of the work.

28. Figures 4 and 3 show the plan and elevation of the lower part of the dam and the position of the temporary dams.

29. The masonry face wall is shown three feet thick at the top and nineteen at the bottom. The rear wall is made three feet at the top and fifteen feet at the bottom, and this should be faced with large and well-dressed stones.

30. It is a minor, but by no means insignificant, advantage of this mode of construction that the water rises as the work proceeds, so that some portion will be diverted to the Madura District before the entire completion of the works, and we shall also have the benefit of water-transport for materials during a great part of the time occupied ; it so happens that owing to the peculiar conformation of the Kythery Valley, this benefit becomes considerable at a very early period.

30. The sill of the water-shed cutting will be 104 feet above deep bed of river and only 31 feet below full lake level. So the keeping of the water up to the level of the dam would at most enable water; and that in comparatively small quantities, to be diverted to the Madura District one season earlier than would otherwise be practicable. This advantage would be far more than counterbalanced by constant interruptions to the work, which, even supposing that no serious damage were to result, would very possibly postpone the diversion of water for more than one season.

Water-transport would be an advantage resulting from the formation of a lake at once, but it would be necessary several times in a season to re-arrange the jetties or other conveniences for the transfer of materials from carts to boats and *vice versâ*. Indeed, seeing that such materials would generally have to be deposited at some distance from the dam itself, it is doubtful whether water-transport with the necessity for breaking bulk twice and for constructing boats would effect any considerable saving.

31. In case it should be considered undesirable to allow water to go over the work during construction, the method described in the following paragraphs might be adopted, the water being passed under the dam by means of the culverts shown in figures 5 to 8.

32. I have given a considerable area (more than 1,800 square feet) to these culverts, as their cost is insignificant, and it is advisable to take advantage of this fact to reduce the velocity of the water passing through them. The area might with advantage be increased but that there might then be a difficulty in closing them properly within the time available.

33. I should mention here that in my demi-official letter to Colonel Mullins I proposed a somewhat different arrangement to that now recommended for passing water under the dam so as to avoid the necessity of closing the openings under any considerable head, but I had not at that time seen the plans of the lake at No. 4 site, and did not know how large its area is and how slowly the water will rise.

34. The general construction will be the same as described in paragraphs 24 and 25, the vents on the flanks of the stream being first built and the connecting portion of the dam being afterwards put in under cover of temporary dams as described in paragraph 25.

35. There are several ways in which these dams might be constructed; probably the best, as taking up least room, would be to jump two rows of iron rods into the rock, strut these with bamboos and let down outside them a framework of bamboos covered with thatch grass, filling the space between with puddle; the leakage would be slight and might easily be kept down by pumps until the masonry had been got into a sufficient height to enable it to be disregarded. This plan was adopted with great success by Mr. Stevenson under conditions somewhat similar to those with which we have to deal.

36. After this the construction of the dam will go on without interruption; it is possible that a very heavy flood occurring during the second season may pass over the work, but the injury to the latter will be limited to the removal of a few stones.

37. The closing of the culverts should begin immediately after the close of the north-east monsoon, say on the 1st December. Eight out of the eleven openings would be first closed, wooden shutters being put down in front of them, and the leakage through these being kept down by pumps, as it could very easily be, as it is not likely that the water-level would rise to more than twelve or fifteen feet above the sills of the open vents.

38. The vents would be built up with solid masonry to a distance of forty feet, and every care should be taken to make the joints between the closing and the culvert arch as sound and water-tight as possible. Portland cement should be used for this part, and the face of the closing wall and soffit of the projecting portion of the arch should be plastered with Portland cement or asphalte.

This wall could be finished in twenty days at the most, and behind it would be a backing of well-rammed concrete and cross walls at intervals of eighteen feet.

39. In order to allow plenty of time for the closing walls to get well set before any pressure come upon them, the closing of the two last openings should not be begun before the middle of January.

40. It will be seen that these two vents are extended for a length of eighteen feet beyond the face of the dam, and a semi-circular shaft fourteen feet in diameter is built above each of them up to seventy feet from the top of the dam.* The shaft, which will be built as an arch, will resist the pressure of the water surrounding it, and, though it may possibly leak, the leakage will not be more than can be easily kept down by pumps until the face wall is completed.

* Fifty-feet above datum.

41. The closing of these three vents will be managed in the same way as for the others, but a drain will be left underneath them, terminating in a small pipe with a conical mouth, the mouth to be closed by a valve. A long bamboo thrust through the pipe will keep the valve open as long as may be desired. The object of this drain will be explained below.

42. As soon as the closing wall is completed, the space under the shaft will be built up with rough masonry, which should not quite touch the closing wall, but be connected with it by a number of square stones, to transfer the thrust of the water to ten feet above the crown of the arch; the remainder of the shaft will be filled in with concrete to the top.

43. The greatest observed discharge of the Perryaur from the 15th January to the end of February has only been ninety-seven millions* of cubic yards, and the average is about seventy millions* only. As the content of the lake up to the point where the shaft terminates is over 100 millions of cubic yards, there will be ample time to get the filling done before the water rises to the mouth of the shaft.

* Including allowance for the drainage received between No. 1 and No. 4 sites.

44. This process may appear long and complicated in description, but it will not be so in reality. I attach the greatest importance to the accuracy of the connection between the tunnels and the closing walls, and to giving the mouths of the former the form shown, so as to prevent the latter from being thrust away from them by the pressure of the water. It is obvious that, if this form of mouth be adopted, the closing, to ensure good work, must be done from the front, and it is for this purpose that the shafts in front of the three vents to be closed last are provided.

45. Another point to which I attach very great importance is the allowing the masonry of the closing walls to get thoroughly set before any pressure of water is brought upon them. It is for this purpose that the drains mentioned above are provided. There is certain to be some leakage through the filling of the shaft, and, if this were allowed to accumulate in front of the closing wall, the latter would of course be under the full pressure due to the water level outside. By allowing it to run off as fast as it accumulates, the wall can be kept free from pressure until the masonry is thoroughly set, when the valve can be closed by the removal of the bamboo which keeps it open.

46. A third method, which, on the whole, I am disposed to prefer to either of the other two, is to close the mouths of the vents by cast iron shutters, and not to attempt to check any leakage that might take place between the shutters and their bearings, but to allow it to run off freely by drains in the bottom of the vents. By this means no part of the filling of the vents would be subjected to the action of water under pressure at all, and the latter might be left altogether unfilled; but in that case, there would be a somewhat excessive pressure on the piers between the vents, and it is desirable to relieve this as much as possible.

47. Figures 9 to 14 show the arrangements proposed to give effect to this scheme;† the number of vents would be the same as before, but their width at the mouth would be only six feet, as the iron shutters would be unmanageable beyond that breadth; this would reduce the area of the mouths of the vents to about 1,340 square feet (still much more than the area of the tunnel proposed for the earthen dam), but, on the other hand, the width of the openings might be greatly increased after the first few feet, and the velocity of water passing through them consequently diminished; this plan gives the increased area where it is most wanted. The sides of the vents along the narrower part would be faced with well-dressed cut stone, and the shutters would slide on iron bearings carefully fitted into the face of the piers and arches. It would be necessary for these faces to be very carefully dressed, and piers, twelve feet long and fifteen feet high, are run out in front of the main piers to enable any one vent to be temporarily closed in order that the shutter bearings may be got ready. The total cost of this plan is nearly the same as that of the first mentioned, and considerably less than that of the second; the dressed stone facing of the rear wall of the first plan and the masonry shafts and expensive filling to the vents of the second being saved.

† Subject of course to modification in details.

48. It is obvious that the efficiency of this plan depends on the amount of leakage between the shutters and the face of the dam. Provided the drains are made large enough, the loss of water is the only evil caused by this leakage, and, unless this is so great as to cause a serious diminution in the supply available for irrigation, the plan would appear better than either of the others,

If the working faces of the shutters and their bearings were carefully planed and well put together, it seems improbable that the leakage could be very great; it would be much less with wooden shutters than with iron ones, and the former would be much cheaper ; it is doubtful whether wood could be trusted as regards durability, but when kept constantly wet, well-seasoned wood will often last for very many years. The insertion of a strip of India rubber between the shutter and its bearing would possibily lessen the leakage a good deal ; but to be of any use, it must reduce that on each face by one half or more, as there would be two faces to leak instead of one. Figure 15 shows a mode of using India rubber for this purpose. It would probably be impossible to slide the shutters along the India rubber without injury to the latter, but there would be no difficulty at all in moving them into position horizontally. For instance, they might be made of wrought iron in the form of caissons, and floated into position ; this would be expensive, but there are many other ways of attaining the same end.

49. With regard to the cost of the works, lime is procurable at Goodaloor, five miles from the foot of the ghaut and fifteen from the site of the dam. I have gone carefully into the details of various means of transport, and have arrived at the conclusion that traction engines will be the best means to employ. Four such engines will be required, and the cost, including plant and all other charges, will not exceed Rupees 2½ per ton, or 2 Annas per parah.* For the pay of bricklayers I allow 1 Rupee per diem, with 25 per cent. added on account of petty establishment, sick men, &c.

* A parah weighs as nearly as possible one hundred weight.

49. The principal material to be brought from a distance for a masonry dam is lime, and of this 400,000 to 410,000 parahs or some 20,000 tons would be required. This is an outside estimate, as the lime would not be slaked before transport.

Supposing the whole of this material to be brought to the work in four seasons of six months each, the average daily traffic would be nearly ... 28 tons

In some further calculations Captain Pennycuick reduces the quantity of lime by one half, so the total load would upon that basis be only 16 tons.

Apparently about 1,000 laborers of sorts would be employed, and their food may be taken to weigh about 2 lbs. per man, say	1 ,,
Tools and stones would not average ...	1 ,,
Total ...	30 tons

The distance that lime would have to be brought is fifteen miles, and the cost of its transport by carts would be 5 to 5½ Annas a parah (4,000 cubic inches), taking Rupees 30 a month as the hire of a cart. Captain Pennycuick has not given the data for his rate of 2 Annas.

50. The cost of masonry will not exceed the following :—

		RS. A. P.
1 Cubic yard of stone		2 0 0
1½ Bricklayers†		1 14 0
2 Coolies...		1 0 0
2 Parahs Chunnam—		
Cost at kilns	0 6 0	
Carriage to site	0 2 0	
	0 8 0	1 0 0
½ Parah burnt clay		0 2 0‡
4 Parahs sand		0 4 0‡
Sundries		0 12 0
Total per cubic yard ...		7 0 0

† This is much more than our schedules allow for work in the plains.

‡ Fancy prices.

50. The undersigned does not think it safe to estimate the cost of rubble masonry at the Perryaur at Rupees 7 a cubic yard. What is known is that everything there will cost more than twice as much as it does in the plains, and work in the latter which could be accepted would cost more than 3½ Rupees. A great many matters have to be

attended to. The stone used in particular layer all over the dam should approximately be of equal size; there must be no large spaces filled is with chips and mortar after the usual fashion; a fashion not perhaps very objectionable where weights and strains are on a small scale.

51. Colonel Fischer informs me that the *highest rate* paid on the Goodaloor ghaut for masonry was Rupees 6, and a great deal was done at much lower rates; as the only extra expense we have is the carriage of lime, and we have the advantage of concentration and working on a large scale, I think the rate of Rupees 7 allowed is ample; for the arch work over the culvert vents I have allowed Rupees 15, and the same rate for the first twenty-four feet of the closing walls, which must be done with great care, and, as already mentioned, in Portland cement. The same rate has also been allowed for the outer three feet of the rear wall if the water is allowed to pass over the dam during construction. For concrete I have allowed Rupees 4 per cubic yard, which is ample.

51. The front face wall would practically be an independent casing wall, and would have to be built very carefully of coursed rubble. Concrete probably will cost more than Rupees 4 a cubic yard.

Ashlar work, such as would be necessary for a culvert, would cost not less and possibly much more than 40 Rupees a cubic yard.

52. There is a small saddle on the left bank of the river which has to be dammed over, and for this I propose to use an earthen dam, and a very small dam will also be required on the water-shed.

53. The total cost will be by the first plan—

		RS.
15,000 cubic yards masonry at Rupees 15	...	2,25,000
93,000 ,, ,, at ,, 7	...	6,51,000
93,000 ,, concrete at ,, 4	...	3,72,000
Benching rock for foundations	...	12,000
Shutters	...	3,000
Working shutters, pumping, &c.	...	5,000
Temporary dams	...	8,000
		12,76,000
Dam over saddle on left bank	...	8,000
,, on water-shed	...	2,000
Total	...	12,86,000

53. The estimates given in this paragraph would need material modification if they are to be compared with the estimate for a silt dam prepared by Mr. R. Smith, and while it is by no means impossible that the rates allowed might, in practice, be approximated to under unusually good executive arrangements, they will not do as an indication of what this part of the project will probably cost. Cut stone work is everywhere costly when granite is the material used, and for any work of this kind a very ample rate will be necessary.

by the second plan it will be—

						RS.
8,000	cubic yards masonry	at	Rupees	15	... ...	1,20,000
113,000	,, ,,	at	,,	7	... ...	7,91,000
3,600	,, arch work	at	,,	15	... ...	54,000
85,000	,, concrete	at	,,	4	... ...	3,40,000
	Benching rock for foundations				... ...	27,000
	Shutters				... ...	4,000
	Working shutters, pumping, &c.				... ...	2,000
	Temporary dams				... ...	8,000
						13,46,000
	Dam over saddle on left bank ...				... ...	8,000
	,, on water-shed				... ...	2,000
					Total ...	13,56,000

by the third—

						RS.
2,200	cubic yards arch work	at	Rupees	15	... ...	33,000
1,000	,, masonry	at	,,	15	... ...	15,000
112,000	,, ,,	at	,,	7	... ...	7,84,000
91,000	,, concrete	at	,,	4	... ...	3,64,000
	Benching rock for foundation				... .	24,000
	Shutters 2,200 square feet at Rupees 20				... ...	44,000
	Working shutters, pumping, &c. ...				... ...	2,000
	Temporary dams				... ...	8,000
						12,74,000
	Dam on saddle on left bank				... ...	8,000
	,, on water-shed				... ...	2,000
					Total ...	12,84,000

54. Against this we have to set, as per Mr. Smith's estimates—

	RS.
Escape tunnel	5,63,481
Reservoir embankment	5,22,600
Silting dam and channels	41,500
Tools, plant, and machinery required for earth work	1,50,000
Labor collectors, and travelling batta, 50 per cent. would be saved by the smaller number of men required	38,000
Total ...	13,15,581

All the other items would remain precisely as in Mr. Smith's project, so that it will be seen that the extra cost of a masonry dam over an earthen one is only Rupees 40,000 at the outside.

55. According to the data taken, 190,000 days' work of a bricklayer would be required for the whole work on the first plan, and 210,000 on the second, and to complete it in 900 working days we should want from 210 to 240 per day. I do not, however, think that all the men employed need be skilled masons, but some of them might be ordinary coolies taught to do mason's work. Lieutenant Greer taught numbers of these men to use the jumper, and they did just as well as the regular miners, and I see no reason why they should not be taught to use the trowel as well. With the pay offered we should have no difficulty in getting the number of men we want.

56. In the event of its being determined to take up this project again in earnest, it would be well to bear in mind that the road from the head of the Goodaloor ghaut to the site of the works has not only to be made, but to be traced. The construction will take one season, during which some other preliminary work can be done, and it would be highly desirable that the trace should be made this year, so as to allow the construction to be taken up next July. The country has already been surveyed, and we know almost exactly the line the road must take, so that the actual trace could be made very easily, probably a month or six weeks would do all that is required.

57. It seems very questionable whether any benefit will be obtained from the reference to Engineers in England or elsewhere. The only doubtful point with reference to the earthen dam is its stability ; we know already that no such dam of any thing approaching the height proposed has yet been constructed, and the chances of success at the Perryaur depend solely upon the superiority of earthwork deposited by silting over that executed by the ordinary processes. This point is precisely the one on which English Engineers can give no opinion, for the simple reason that they know nothing about it, having never seen the process in operation on any large scale. With regard to the masonry dam, the question is resolved into one of cost and time ; and these depend upon local considerations.

VELLORE, (Signed) J. PENNYCUICK, Captain, R.E.

13*th October* 1875.

SUBMITTED for the information of Government with such marginal remarks on Captain Penycuick's Note* as appear to be required.

* Dated 13th October 1875.

(Signed) A. DEC. SCOTT, Major, R.E.,
Assistant Chief Engineer,
Irrigation Department,
for *Chief Engineer for Irrigation.*

No. 560-A. From Colonel J. CROFTON, R.E., Deputy Secretary to the Government of India, Public Works Department, (Civil Works—Irrigation), to Major-General G. W. WALKER, R.E., Secretary to the Government of Madras, Public Works Department, Irrigation Branch, dated Fort William, 28th March 1876, No. 159 I.

I am directed to acknowledge the receipt of your letter, No. 1,194, of 30th April 1875, with which were transmitted the papers connected with the Perryaur project, for the development of irrigation in the Madura District, and which was accompanied by a request that they might be referred through the Secretary of State to the highest engineering authorities in the United Kingdom for consideration and for the elaboration, if possible, of some means whereby the great risks attendant on the proposed method of construction might be eliminated, and, in reply, to make the following observations.

2. The Government of India has attentively considered the papers submitted, and the request of the Madras Government to refer them to engineering authorities in England, and has been awaiting the receipt of the further investigations ordered in paragraph 4 of Madras Government's Resolution, No. 1,193, of 30th April 1875. The result of those investigations has, however, only recently come to hand—*vide* enclosures to Despatch No. 5, of 7th February last, from the

Madras Government, to the Secretary of State. Moreover, the Government of India is not yet in possession of the whole of the papers relating to the Perryaur Project, for those last received show that other documents have been reviewed since the 30th April 1875 by the Government of Madras, which have not been forwarded to the Government of India.

3. I am to say, however, that the Government of India considers that, if among the Engineers of India whose experience in the construction of irrigation works must far exceed that of those in any other country in the world, a sound opinion cannot be arrived at, it will be hopeless to think of relying on that of any of the English engineering authorities named in the papers sent up by the Government of Madras, as they have had little or no practice in the special branch of engineering with which the scheme under discussion is concerned. The Governor-General in Council, therefore, does not consider that any useful purpose would be served by transmitting the papers connected with this project to the Secretary of State for consideration by English Engineers.

4. The Government of India is, however, willing, so far to meet the views of the Government of Madras, as to refer, when the whole of the papers and information connected with the scheme have been received, the various questions involved for the consideration of a Committee composed of the officers named below:—

Colonel J. Crofton, R.E., Inspector-General of Irrigation Works to the Government of India.

Colonel F. T. Haig, R.E., Chief Engineer of Irrigation to the Bengal Government.

Mr. Bradford Leslie, C.E., Engineer to the Calcutta Municipality.

And in addition, if it seems desirable to the Madras Government, one of its own officers thoroughly acquainted with the locality, and who is also intimate with the details of the project itself.

5. The report on the question of substituting a masonry for an earthen dam, which, it is understood from one of the enclosures to the letter to the Secretary of State above alluded to, was in contemplation some months ago, should also be submitted, together with some further information regarding the Perryaur channel at the site of the proposed dam. In none of the reports is there any clear description of the geological features of the site or of the nature of the rocky stratum, whether fissured or compact throughout. The facilities for obtaining good building stone and lime should also be noticed.

6. The delay, I am to observe, in the disposal of this question will not be of material consequence; as in the present state of the finances, it is not likely that funds will be available for any works except those actually in progress for some time to come.

7. A copy of this communication will be forwarded to the Secretary of State.

No. 561. ORDER THEREON, 27th June 1876, No. 1,619.

IRRIGATION, No. 35.

ORDERED that the following letter be sent.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 562. From the Secretary to the Government of Fort St. George, Public Works Department, to the Secretary to the Government of India, Public Works Department, dated 27th June 1876, No. 1,620.

IRRIGATION, No. 35-A.

Sir,—I am directed, in reply to your letter, No. 159, of the 28th March last, to transmit, for the information of the Government of India, a copy of the Proceedings of this Government, as per margin,* containing the further information on the engineering features of the Perryaur project which has been obtained since orders were passed on the papers printed in Proceedings, Madras Government, of the 30th April 1875, No. 1,193.

* No. 2,281, dated 6th August 1875.
,, 205, ,, 26th January 1876.
,, 1,619, ,, 27th June 1876.

2. I am at the same time to transmit a copy of the Proceedings of this Government in the Revenue Department in which the arrangements for ascertaining definitely what results may be expected from the diversion of water from the Perryaur to the plains of Madura will be found detailed.

No. 1,236, dated 16th August 1875.
,, 1,436, ,, 29th September ,,
,, 1,594, ,, 6th November ,,

3. With regard to the latter part of paragraph 5 of your letter, I am to say that Mr. R. Smith, the officer who was best acquainted with the site, No. 4, ultimately chosen for the dam, died in January last, and it is difficult, therefore, to obtain at the moment more precise information as to the nature of the rock at this site. A description of the rock at sites Nos. 2 and 3 is, however, given in paragraph 6 of a Note by the Chief Engineer for Irrigation, and it is believed that the character of the rock there does not materially vary from that at site No. 4. From various parts of Mr. R. Smith's reports it may be inferred that the rock is everywhere solid and compact, *e.g.*, "It is generally admitted that the best foundation for a reservoir embankment is clay, and that the next in order is compact rock. If the Perryaur Lake embankment is constructed at No. 2 or at No. 3 site, the foundation will be the same material, *i.e.*, sound rock." Again "The escape tunnel has been aligned and planned to suit the contour of the solid rock." Also in the memorandum on the head works proposed for No. 4 site: "The reservoir embankment will be composed of silt throughout, and, to guard against leakage in the base or sides, trenches will be cut in the rock in the bed of the Perryaur and on both banks of this river.

Proceedings of the Madras Government, No. 3,763, dated 26th November 1869, copy enclosed.

Paragraph 9 of memorandum, dated 30th October 1871.

Proceedings of the Madras Government, 30th April 1875, No. 1,193.

Paragraph 48, 30th April 1875, No. 1,193.

Dated 15th April 1872, paragraph 3.

"The tunnel to pass the Perryaur during the formation of the reservoir embankment will be cut in the rock on the left bank of this river."

Paragraph 26.

Referring to the site for the permanent escape, it is remarked that the average level of the compact rock is 120 feet above datum, and there are

Paragraph 32.

many other passages tending to show that there is solid rock almost everywhere at no great distance below the surface, while in the bed of the river it is exposed. Though nowhere so recorded, the Chief Engineer for Irrigation, who visited the Perryaur in 1869, is of opinion that the whole of the rock is of igneous formation, and that there is any quantity of stone suitable for either rubble or ashlar masonry. Lime is obtainable at Goodaloor "five miles from the foot of the ghaut and fifteen from the site of the dam."

Paragraph 49 of Captain Pennycuick's Note, dated 13th October 1875.
Proceedings of the Madras Government, No. 1,619, of 27th June 1876.

4. Having now supplied all further information available that can be given regarding this project, I am further directed to say that, with all deference to the judgment of the Government of India, the suggested Committee does not appear to meet the object sought by the Government of Madras. The Governor in Council is of opinion that this scheme should not be considered by a Committee composed only of Indian Engineers. It is not by such a Committee that the object proposed in paragraph 3 of the Proceedings of Government, No. 1,193, of 30th April, can be attained. That object was to obtain the opinion of the highest engineering talent available either in the United Kingdom or elsewhere as to the best means of dealing with the problem that has to be solved—the construction of the proposed work with other materials, such as stone or iron, in lieu of silted earth. There is little or no experience available in this country as to design and construction in such materials; while it is believed that there are extensive works of this nature elsewhere from the constructors and designers of which valuable advice and information might be obtained. If His Excellency the Viceroy in Council is unable to see his way at the present to making the reference suggested, His Grace the Governor in Council will have to consider this important and interesting question as for the present laid aside.

No. 576. Read the following letter from Captain L. CONWAY-GORDON, R.E., Examiner of Public Works Accounts, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Fort St. George, 13th June 1876, No. 62 W. :—

ADVERTING to G.O., No. 1,053, dated 27th April 1876, authorizing the District Engineer, Presidency, to indent on the Mysore Government for certain tools (jumpers) for the Public Works Stores, I have the honor to inquire to what head of service and to what fund it is intended that the cost of such tools shall be charged.

No. 577. ORDER THEREON, 27th June 1876, No. 1,628.

IRRIGATION, No. 36.
Account.

THE cost will be charged to Irrigation, Tools and Plant, and will be met from the allotment at the disposal of the General Superintendent of Public Works Stores.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 614. Read the following Proceedings of the Board of Revenue, dated 10th June 1876, No. 1,529 :—

From C. T. LONGLEY, Esq., Collector of Salem, to C. A. GALTON, Esq., Acting Secretary to the Board of Revenue, dated Shevaroy Hills, 23rd May 1876, No. 119.

WITH reference to paragraph 4 of the Board's Proceedings of the 25th August last, No. 2,410, I have the honor to enclose a statement received from the Head Assistant Collector showing the Mutta and Inam tanks affecting the railway and the steps taken, if any, by the proprietors for their repair. Almost all the Inam tanks have been put in order. It is only with regard to the *Mutta* tanks that it has not been found practicable to induce every one of the proprietors to carry out the work. Some have done it, while others have either done it partly or have failed altogether to do so. But a notice in accordance with the terms of the Privy Council judgment ( ) has however been served on all the Muttadars in question, and those who decline to carry out the works, stated by the professional department to be necessary to ensure the safety of the tank, do so at their own risk.

ENCLOSURE No. 1.—Statement.

SUBMITTED for the information of Government with reference to G.O., dated 21st September 1875, No. 2,724, Public Works Department.

(A true Copy and Extract.)

(Signed) C. A. GALTON,
Acting Secretary.

No. 615. ORDER THEREON, 30th June 1876, No. 1,648.

IRRIGATION, No. 37.

THE particulars of private tanks given in columns 4 to 7 of the statement which accompanied the Proceedings of the Board of Revenue above recorded, have not been shown in a manner which can be readily understood, and the heading of column 5 is capable of improvement. The information required would be more conveniently exhibited were the following particulars recorded :—

Length of calingulah necessary.
Do. do. available.
Do. do. difference required.
Required height of bund above full tank level.
Actual do. do.

and the work done might be shown either in additional columns or under "Remarks."

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 518. Read the following letter from Colonel F. J. MOBERLY, R.E., Superintending Engineer, Chingleput, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Mount, 16th April 1876, No. 489 :—

WITH reference to G.O., No. 2,571, dated 8th September 1875, I have the honor to reforward the estimate for restoring damages done to Kesavaram anicut and head wall during the floods of October 1874, with an abstract showing distinctly the several items of work to be done, &c.

1 Estimate.
1 Statement.

2. I submit a list of tanks which receive a supply from the Kuam, with the irrigated area under each. I presume that their returns may be credited to the Kesavaram anicut in some degree.

———

Statement showing the Tanks of Villages benefited by the Anicut across the Cortelliar at Kesavaram throwing Water into the Kuam and the Acreage under each.

Name of Village.	Acres.	Assessment. RS.	A.	P.	Remarks.
Sydapet Taluq.					
Chembrumbaukum Tank	9,668·26	47,875	15	3	
Theroomooshy do.	518·72	2,374	11	3	
Thinnanoor do.	528·95	1,871	9	3	
Goodapakum do.	254·25	884	0	4	
Namum do.	1,605·73	7,897	14	7	
Parithipattoo do.	549·26	1,728	7	6	
Parivakam do.	154·69	464	7	11	
Korattoor do.	1,009·24	2,926	14	10	
Trivellore Taluq.					
Cassanganallattur	220·84	762	6	10	
Ca[illegible]battoor	175·00	778	2	2	
Salay	241·50	1,047	14	2	
Pareacooppam	} 281·71	1,049	0	9	
Pooleyancooppam	434·8	1,492	4	6	
Thanneercolum	250·99	890	12	4	
Poothoor	395·13	1,609	0	4	
Thodur	215·00	855	0	0	
Agaram					
Government Tanks ...	6,835·81	26,632	10	9	
Pinjivakam	677·53				These being Zemindary Tanks, the assessment under them is not known.
Atheegathoor	944·73				
Yagathoor	516·38				
Theroovoor	1,294·73				
Arenvoil	757·0				
Poongathoor	508·68				
Zemindary Tanks ...	4,699·65				

MOUNT,
16th May 1876,

(Signed) F. J. MOBERLY, Colonel, R.E.,
Superintending Engineer, Chingleput

No. 618-A. Memorandum from the Chief Engineer for Irrigation, 23rd May 1876, No. 34 C.N.

No. 618-B. From Colonel F. J. MOBERLY, R.E., Superintending Engineer, Chingleput, to Lieutenant-Colonel J. MULLINS, R.E., Chief Engineer for Irrigation, dated Chingleput, 18th June 1876, No. 962.

1 Estimate.
1 Statement.

IN reply to your No. 34 C.N., 23rd May, I have the honor to observe that G.O., No. 2,571, 8th September 1875, was passed on papers regarding the Kesavaram anicut, not only the Chembrumbaukum tank.

2. The acreage under the former work was then given as 16,165 acres; from more accurate examination it turned out that it should have been 16,704.

3. When I examined the details I found several omissions which were corrected before I prepared my return of 16th May 1876.

4. I am not aware that any contribution has been levied from Zemindar, but have applied to the Collector for information.

5. I regret that I do not understand your last paragraph.

No. 618-C. From Captain L. CONWAY-GORDON, R.E., Examiner of Public Works Accounts, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Fort St. George, 29th May 1876, No. 55 W.

WITH reference to G.O., No. 1,107, of the 4th May 1876, I have the honor to inquire—

1*st*.—Whether the intention of Government is that the share chargeable to the Chembrumbaukum tank shall be debited to "Revenue, Maintenance and Repairs," and the balance to "Ordinary Agricultural, Repairs."

2*nd*.—To what head or heads of account, and in what proportions the expenditure is to be charged, pending the determination of the shares.

2. The determination of these shares is hardly likely to be arrived at for several years more, and in the mean time it seems necessary to have some definite ruling as to the treatment not merely of expenditure against the estimate now sanctioned, but of all outlay on the Kesavaram anicut.

No. 79. W.

No. 618-D. *Note by the Chief Engineer for Irrigation.*

IN G.O., 4th May 1876, No. 1,107, an estimate of Rupees 11,100 was sanctioned for certain repairs and reconstructions at the Kesavaram anicut and head works, and the debit of the charges was ordered to be made to the Chembrumbaukum tank, and to other works, in shares to be determined with reference to the respective ayacut areas under the works. The Superintending Engineer has furnished the required informa-

tion, and from the statement, dated 16th May 1876, which was transmitted with his letter, No. 489, it appears that the Chembrumbaukum tank has an—

	Ayacut. Area. Acres.	Ayacut. Assessment. Rs.
	9,668	47,876
7 Government Tanks, Sydapet Taluq / 9 Do. Trivellore " ...	6,836	26,633
6 Zemindary Tanks	4,700	...
	11,536	
	21,204	

There is consequently a total area of acres 21,204 under the Kesavaram anicut, of which $\frac{9,668}{21,204} = 0 \cdot 46$ of the total belongs to the Chembrumbaukum Tank Project, and $\frac{11,536}{21,204} = 0 \cdot 54$ belongs to other works. Taking into account that the Chembrumbaukum tank will probably derive more benefit from the Kesavaram anicut and old Bungairoo mprovements, than the rest of the irrigation thereunder will receive, it is thought that a sufficiently close approximation will be secured if the expenditure under the estimate of Rupees 11,100, in common with all outlay recorded on these works since the Chembrumbaukum Tank Project was undertaken, be divided in equal shares between that tank and other works.

Ootacamund, (Signed) J. MULLINS, Lieut.-Colonel, R.E.,
26*th June* 1876. *Chief Engineer for Irrigation.*

To the Secretary to Government, Public Works Department.

No. 619. Order thereon, 30th June 1876, No. 1,650.

IRRIGATION, No. 38.
Account.

The Government approve of the adoption of the recommendation that all outlay on the Kesavaram anicut and old Bungairoo, which has been incurred since the Chembrumbaukum Tank Project was undertaken, should be charged in equal shares to that project and to other works respectively.

2. The Examiner of Accounts will be informed in reply to his reference that the share of expenditure under the estimate of Rupees 11,100 chargeable to the Chembrumbaukum tank will, as already intimated in G.O., No. 1,107, of the 4th May 1876, be debited to Revenue, Maintenance and Repairs, while the share belonging to "Other Works" will be debited to Ordinary Agricultural, Repairs.

3. Should it be found that the irrigation under Zemindary tanks is liable for any share of the cost of maintaining the Kesavaram anicut and old Bungairoo, the contributions levied will be credited to Ordinary Agricultural.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 622. Read the following Proceedings of the Madras Government in the Financial Department, dated 21st June 1876, No. 1,134.

Read the following papers :—

Letter from the Acting Collector of Kurnool, dated 30th May 1876, No. 240.

Telegram from do. of do. „ 13th June 1876.

THE Governor in Council is greatly disappointed to find that nothing whatever has yet been done to give effect to the urgent instructions conveyed by the G.O. of 1st April 1876, No. 610, Financial, and cannot at all accept the Acting Collector's opinion that work cannot be commenced before the monsoon begins nor the channels be taken in hand till after the monsoon is over.

2. The Assistant Engineer, Mr. Johnston, who will be relieved from charge of the District by Mr. Goodchap on 15th instant, will be instructed by telegram to proceed forthwith to Cumbum and assume executive charge of the work directed by Government to be carried out, and the Acting Head Assistant, Mr. Farmer, now on leave on the Hills, will be advised by Mr. Johnston, by telegram, of the date on which he will reach Cumbum, and will arrange to join him there on that date, and to give all the assistance in his power for the speedy prosecution of the work. His privilege leave will be cancelled from the date on which he leaves the Hills on this duty.

3. Mr. Foster will be instructed by telegram to arrange with Major Hasted to meet in conference at Cumbum at the earliest possible date. He will observe from paragraph 14 of the G.O. of 1st April that many other and more primarily important questions than the selection of the site for the temporary offices were referred for the consideration of the Committee nominated, and the Governor in Council is by no means satisfied that the association of the Sanitary Commissioner with the other members in their discussion would be devoid of advantage upon questions affecting the health of a considerable population.

4. He desires that in any case no further delay be allowed to interfere with the most urgent prosecution of this work to which the Government attach very great importance.

5. Weekly reports of progress will be submitted to Government by Messrs. Johnston and Farmer.

(True Extract.)

(Signed) W. HUDLESTON,
Chief Secretary.

No. 623. ORDER THEREON, 30th June 1876, No. 1,652.

IRRIGATION, No. 39.

COMMUNICATED to the officers concerned in continuation of G.O., No. 1,094, of the 1st May 1876.

2. Instructions have been sent to the District Engineer, Kurnool, for Mr. Johnston's guidance, and the Chief Engineer, Public Works Department, has learnt that Mr. Johnston was at Cumbum on the 9th instant.

3. Major Hasted will consider himself authorized to sanction on emergency the immediate execution of any work which he may consider would have an immediate effect on the improvement of the drainage of the irrigated lands under the Cumbum tank. He will learn from the instructions given by the Chief Engineer for Irrigation, what works have been ordered to be carried out as emergent, pending the preparation of estimates for the complete reformation of the channels, and when he has made himself acquainted with the circumstances of the irrigation he may find that other improvements are urgently required.

No. 12 K.R., dated 12th June 1876.
" K.R., " 14th "

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 633. Read the following endorsement of the Chief Secretary, dated Ootacamund, 24th June 1876, No. 994 :—

From J. H. TAYLOR, Esq., Lieutenant, R.N.R., Master Attendant, Administrative Department, to the Hon. W. HUDLESTON, Chief Secretary to Government, dated Madras, 21st June 1876, No. 4,082.

I HAVE the honor to acknowledge receipt of your memorandum, No. 913, of the 17th instant, and to state that an inquiry has been made from Messrs. Witber and Company, of False Point, regarding the terms of sale and description of the Steamer *Prince*, to which I have duly replied. I am also in communication with the Marine Departments at Bombay and Calcutta, and will make a final report to Government on the subject shortly.

2. It is, however, highly advisable that the very earliest opportunity be taken of getting the *Prince* over the anicut. She is no use above it, and the chances of a good market for her are yearly much reduced by deterioration, and she requires to be seen to secure any purchaser.

TRANSFERRED to the Public Works Department for the issue of the necessary instructions.

(Signed) W. HUDLESTON,
Chief Secretary.

No. 633-A. From Major J. BEATTY, R.E., Acting Superintending Engineer, Godavery, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Dowlaishweram, 20th November 1875, No. 2,505.

WITH reference to the latter part of G.O., No. 2,936, of 14th ultimo, I have the honor to report that it is not possible to have the *Prince* brought down to Cocanada at once, as the season of freshes in the Godavery is over for this year, and, owing to her great width, that steamer cannot pass through the locks on the canal.

2. It would not be safe to attempt taking the *Prince* over the anicut in a fresh of less than 8 to 9 feet, and such freshes occur in this river only between the

10th of July and 10th of October; with less than 8 feet the draught of the vessel, the anicut posts, and the great afflux, would make it a dangerous operation. This year there was more than 8 feet on the anicut from 25th to 30th July; 17th to 20th August; 10th, 11th, and 16th to 20th September.

3. In memorandum of 30th June 1875, Colonel Mullins recommended that the opinion of the Master Attendant at Cocanada should be obtained as to the *Prince's* fitness for Harbour service. That officer inspected her in September last, when there was 7 feet of water passing over the anicut and a strong current, and in order that he might be able the better to judge of her fitness for other service the vessel was taken the same day with him on board five miles up the river.

4. Captain Castor pronounced the *Prince* not adapted for service at Cocanada as, owing to her great size, she would be an obstruction to traffic in the little creek that goes by the name of a river at Cocanada; but he considered that she would be of use at Cochin, and stated that he would be willing, if required, to take her there himself in the quiet season of the year about December or January. He promised to report this at once, but apparently the Master Attendant at Madras took a different view of the case.

5. In my letter, No. 895, of 17th June 1875, I recommended that the *Prince* should, under any circumstances, be taken over the anicut in the first high freshes. As this was not done, she must now lie at Dowlaishweram until July next, and I request permission to take advantage of the first high fresh in that month to have her sent over the anicut. There is a greater probability of a sufficiently high fresh in July than in any other month.

No. 634. ORDER THEREON, 30th June 1876, No. 1,658.

IRRIGATION, No. 39-A.
Account.

RECORDED, pending the further report promised.

2. Instructions have already been issued to bring the Steamer *Prince* over the anicut (G.O., No. 1,523, dated 20th June 1876.)

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 639. Read the following letter from Colonel C. H. DICKENS, R.A., Secretary to the Government of India, Public Works Department, (Account—Irrigation,) to Major-General G. W. WALKER, R.E., Secretary to the Government of Madras, Public Works Department, Irrigation Branch, dated Simla, 15th June 1876, No. 235 A. I. :—

I AM directed to acknowledge receipt of the application, No. 17-A., dated 3rd May 1876, for a re-appropriation of budget credits for 1875-76, and, in reply, to say that, as it is understood from the Proceedings quoted in the margin that the transfers in question have already been authorized by the Government of Madras, the Government of India have been pleased to confirm the action taken in the matter.

Nos. 511 and 512, dated 30th March 1876.

2. I am, however, to point out that, as regards the re-appropriations for improvements to the Survapully channels, it would appear that the outlay on the work to end of 1876-77 is likely to exceed the sanctioned estimate by Rupees 26,685. This amount is in excess of the sum which under the rules in force can be passed by the Government of Madras, and I am, therefore, to inquire what the total cost of the work is likely to amount to, and, if a revised estimate is necessary and requires to be submitted to the Government of India, when it may be expected to be received. The Governor-General in Council would feel obliged for a very early reply.

	RS.
Actual outlay to end of 1874-75 ...	4,00,243
Grant, 1875-76	25,502
Do. 1876-77	21,000
	4,46,745
Estimate	4,20,060
Probable excess	26,685

Public Works Department Circular No. 44 of 1872.

No. 640. ORDER THEREON, 30th June 1876, No. 1,661.

IRRIGATION, No. 40.
Account.

RECORDED and communicated to the officers concerned.

2. The District Engineer, Nellore, will give immediate attention to paragraph 2 of the letter of the Government of India, and will report when the revised estimate will be ready, and what the amount of it is likely to be.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.

No. 641. Read the following letter from Captain G. P. SKIPWITH, R.E., Assistant Secretary to the Government of India, Public Works Department, (Civil Works— Irrigation,) to Lieutenant-Colonel J. MULLINS, R.E., Joint Secretary to the Government of Madras, Public Works Department, Irrigation Branch, dated Simla, 15th June 1876, No. 250 I. :—

I AM directed to forward, for information, two copies of high-flood discharges of the great rivers of the North-western Provinces.

No. 642. ORDER THEREON, 30th June 1876, No. 1,662.

IRRIGATION, No. 41.

ORDERED that one copy of this pamphlet be circulated for the perusal of the under-mentioned officers, and for return by the last-named to the office of the Chief Engineer for Irrigation.

(Signed) G. W. WALKER, Major-General, R.E.,
Secretary to Government.